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Life Insurance for the Digital Age: An End-to-End View

By Nitin Nayak and Stephen Abrokwah
Page 4

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475 N. Martingale Road, Suite 600
Schaumburg, Ill 60173-2226
Phone: 847-706-3500 Fax: 847-706-3599
www.soa.org

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Chairperson's Corner

Why I Volunteer

By Kelly Rabin

As a new FSA, I remember sitting in the audience at SOA meetings, watching speakers present. Who were they? Why were they taking the time to present? How did they know all this stuff? I then noticed that most of the presenters were reinsurers and consultants and it was often the same people speaking about the same topics. While their perspectives were extremely valuable, I was working at an insurance company at the time and craved insight from those who worked in the same environment. But company product actuaries often either didn't want to give away their secrets or weren't encouraged by their companies to volunteer.

As a former consultant myself, I wholly recognize that consultants and reinsurers have a lot more financial incentive to take time out of their busy work schedules to volunteer. Volunteering is not just giving back in that case—it is also part of marketing your brand. Don't get me wrong—speaking at a session, planning a meeting, or writing an article each take a lot of time. I am very grateful to each and every one of our volunteers. The SOA is as well, and has even launched a new volunteer recognition program in the last couple years to reward volunteers for their efforts. That said, I would love to see new volunteers and fresh perspectives—no matter where you work.

So, why volunteer for the SOA—and more specifically, the Product Development Section?

1. You meet amazing people. Our volunteers are some of the most creative and dedicated people I know. I enjoy getting perspectives from all different facets of the profession, even including some international practitioners. Expanding your personal network is always worthwhile.
2. You are first to hear breaking news in the SOA product space. Whether that is new research, upcoming meetings to plan for, or new SOA initiatives, you hear about it before the general membership. This just might make you more successful at your job!
3. You have the chance to give back. The SOA is an organization run mostly by a lot of volunteers and some amazing staff. If you don't lend a hand, who will? We want your fresh perspective!

The last three years on the PD Section Council have been very rewarding. I have learned a lot about how the SOA works and how to motivate volunteer leaders, as well as met some fabulous people who I might not have met otherwise. Our section is stronger than ever. We have over 2600 members. We spend over $100,000 on research every year that directly benefits those who practice in product development. We partner with other sections on topics like PBR and in-force management. I am proud to have been your chair, and excited to move into my next volunteer role as chair of the Life & Annuity Symposium for the next two years.

How will you step up and make a difference? I hope that I get to sit in your session next year or read your newsletter article so I can think, "this is a really cool perspective; I'm so glad this person decided to volunteer!" ■

Kelly Rabin, FSA, CFA, MAAA, can be reached at *kellyrabin@gmail.com*.

Life Insurance for the Digital Age: An End-to-End View

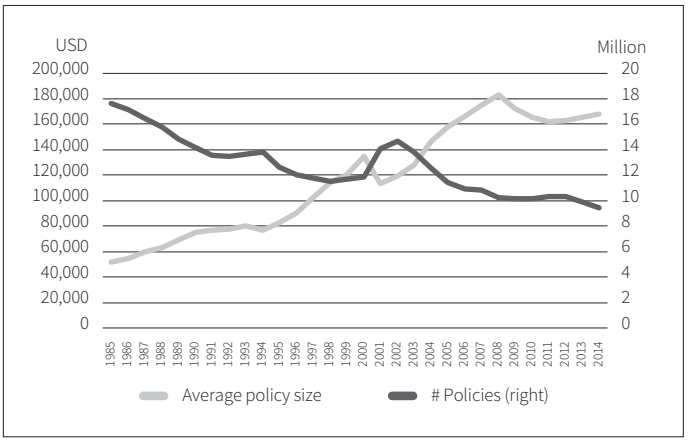
By Nitin Nayak and Stephen Abrokwah

According to a Swiss Re study, life insurance ownership has declined at a dramatic rate over the past 30 years and is currently at a 50-year low.[1] This situation is most pronounced among the middle market and millennial households. Declining sales partly explain the research estimates of the life insurance protection gap,[2, 3] which has been estimated to exceed USD 86 trillion globally and USD 20 trillion within the United States alone. The average household protection gap within the United States is now estimated to be just under USD 400 thousand.

Independent and captive agents constitute the majority of the existing distribution channels for life insurance products, and they have gradually migrated toward supporting mostly high net-worth individuals for larger face amount policies (See Figure 1). As a result, many in the mid-market segment are left to their own sources for both educating themselves and purchasing life insurance products.

With a greater availability of both internal and external data, along with advances in predictive models, an increase in competitive pressures, and a shift in demographics toward millennial and Gen X generations, it is now an opportune time for primary insurers to reassess the traditional approaches for addressing the protection gap. The industry has started examining this issue from multiple viewpoints along the customer journey. Recommendations include educating customers about the value and affordability of life insurance, reducing the friction and waiting times in the buying process, and improving the quality and speed of assessing/pricing customer's mortality risk. As a result, existing actuarial methods are being supplemented with several nontraditional data sources and modelling techniques, which are currently in various stages of deployment. This article provides an overview of various innovative solutions supporting an end-to-end underwriting process for life insurance products.

Figure 1
Individual Life Insurance Sales[4]



Source: Swiss Re Economic Research and Consulting.

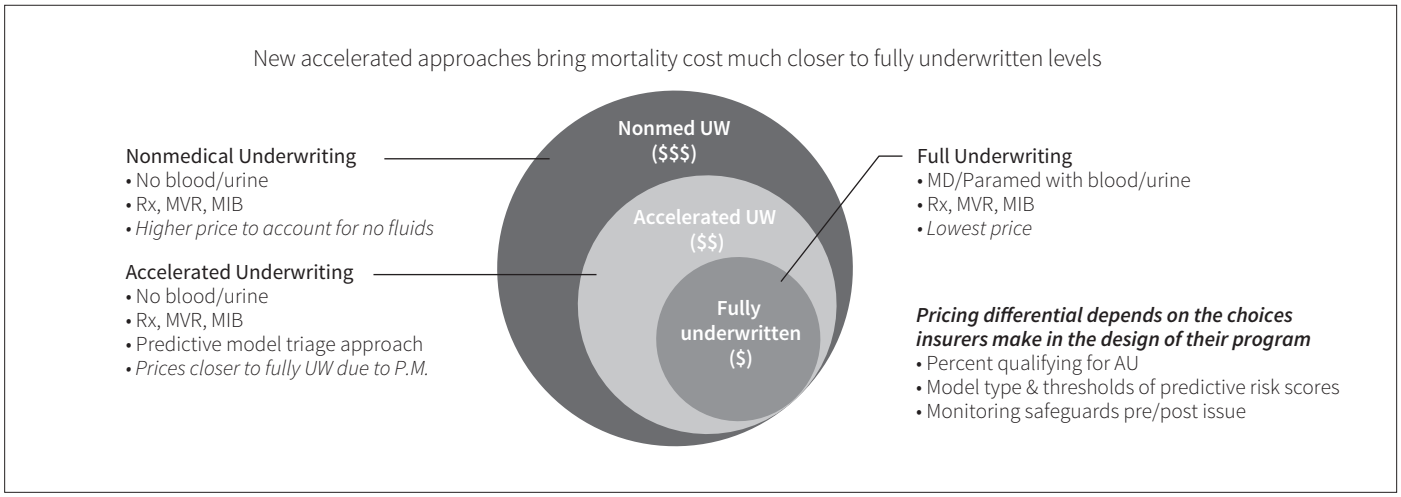
EVOLUTION OF THE TRADITIONAL LIFE INSURANCE BUYING PROCESS

Life insurance plays an important role in protecting households and families from the dire financial impact of uncertain mortality. Over the years, actuaries have developed robust estimates of life expectancy by using mortality tables to predict aggregate insured population mortality as well as dependable underwriting techniques to assess the relative risk of an individual. Though these techniques have been widely accepted within the insurance industry for many years, the traditional life insurance underwriting process is time-consuming, invasive and costly. Typically, a life insurer spends about a month and several hundred dollars underwriting each proposed insured, with underwriting costs ultimately passed on to policyholders through increased premium rates.[3]

Over the years, the life insurance industry has been gradually streamlining the underwriting and customer sales processes to make them less invasive and to provide a more timely response. Some early enhancements included simplified issue products with easier application requirements and nonmedical underwriting for smaller face amounts, and refinements of underwriting guidelines based on protective value studies.

The increased availability of individual-level data, new sources of nontraditional information, and advances in machine learning techniques have created an opportunity for life insurers to embrace innovations in various areas along the insurance value chain. In the context of underwriting, this innovative revolution utilizes predictive analytics, underwriting automation and business intelligence to underwrite with faster turnaround times, reduced costs and fewer invasive medical requirements. This win-win situation for insurers and prospective policyholders should help insurance companies to increase sales, improve their bottom line and provide a better customer experience to proposed insureds. This transformation, however, is not without its challenges, especially when it comes to the mortality

Figure 2
Mortality Cost Implications of Various Underwriting Approaches



implications. Figure 2 shows the relative increase/decrease of mortality costs for various approaches being explored within the industry. In comparison to a full underwriting process with its detailed and time-intensive procedures, the faster nonmedical (no paramedical exam, blood or urine test, or attending physician statement) underwriting process increases the expected mortality cost. Alternatively, transitioning from nonmedical underwriting to fluid-less underwriting, supplemented with predictive analytics, can bring expected mortality to levels closer to that of a fully underwritten process.[5]

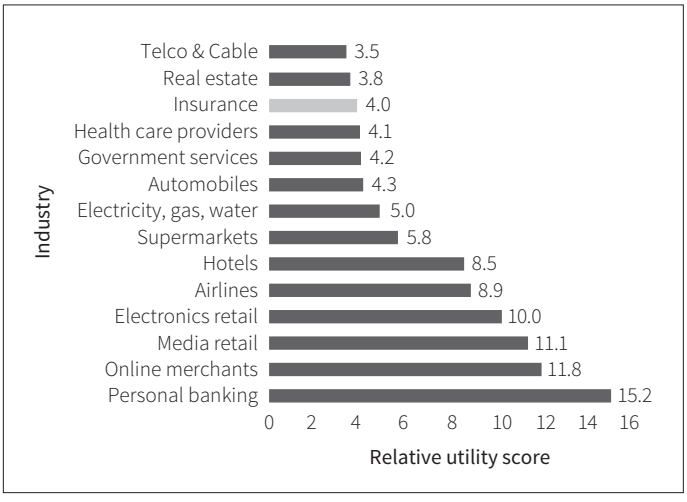
LIFE INSURANCE FOR THE MIDDLE MARKET AND MILLENNIAL GENERATION CONSUMERS

Life insurers can learn much from other industries, including online retail and personal banking, to improve the customer satisfaction of their consumers. This is especially true for the millennial generation who would likely prefer to purchase life insurance products online. Figure 3 shows the results of a consumer survey regarding satisfaction with online experiences across various industries. Clearly, the insurance industry lags behind when it comes to delivering a satisfactory online consumer experience.

To increase customer satisfaction, especially for the millennial generation, we suggest primary insurers offering life insurance products consider the following consumer expectations:

- The ability for the consumer to get a quick tutorial on life insurance products, with a concise explanation of their benefits
- An individualized needs analysis for each consumer, along with a recommendation for various life insurance products (term versus permanent), and face amounts based on their individual life situation.
- A simple application process requiring fewer questions, with as many fields in the application prefilled with user-specific information as appropriate
- A quote delivered in real time describing the policy coverage and associated premium and payment options, similar to the experience of purchasing automobile insurance online
- A set of relevant quote alternatives, each outlining policy coverages and associated premiums for the user to compare to the face amount originally requested by user
- A view of life insurance and related products (e.g., riders and term periods purchased by the consumer's peers in order to assist with decision making)

Figure 3
Consumer Satisfaction with Online Experience by Industry[6]



The next section presents a view of the end-to-end process for purchasing life insurance products from the perspective of a life insurer.

OVERVIEW OF INNOVATIONS FOR ACCELERATED UNDERWRITING IN LIFE INSURANCE

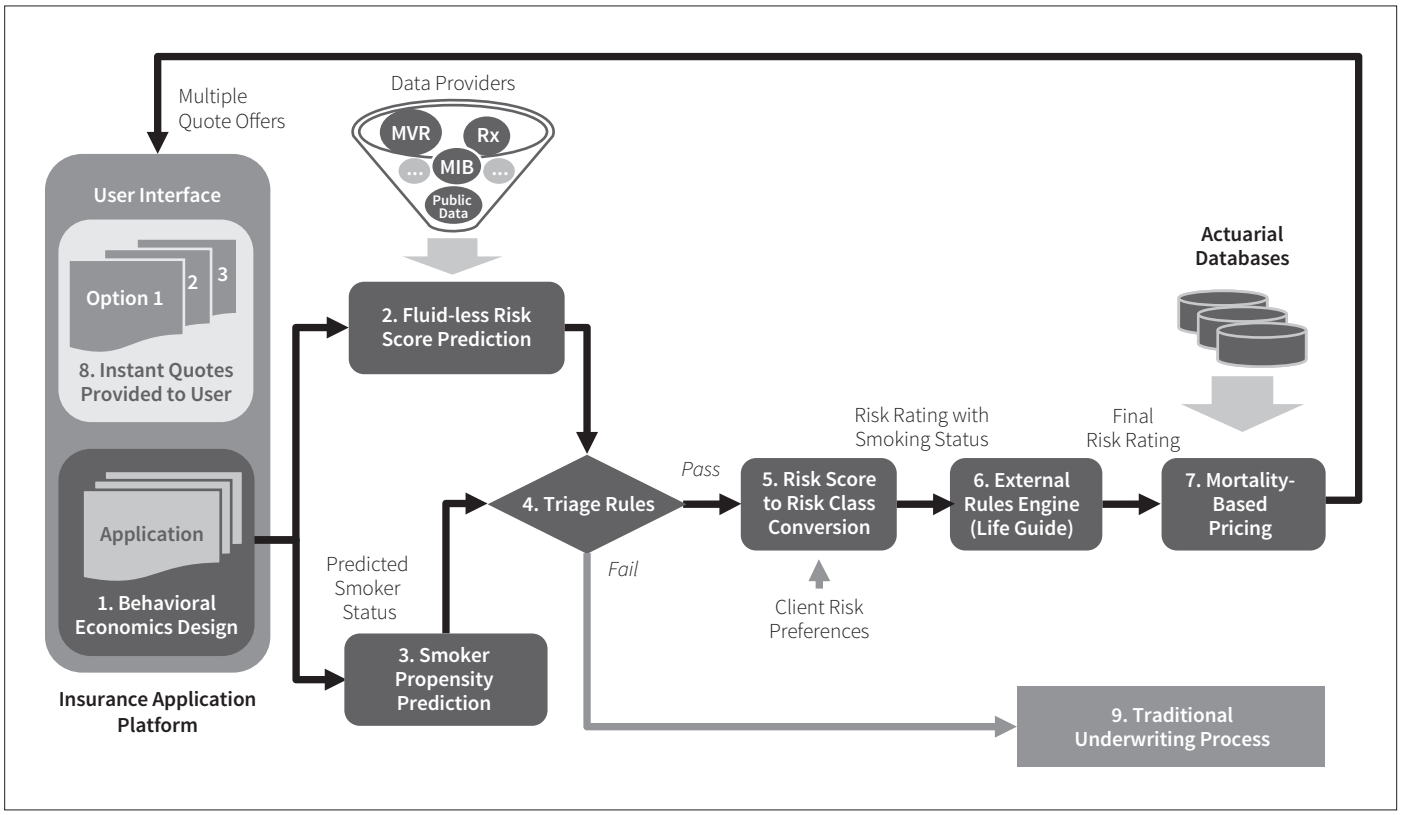
This process starts with the customer being presented an online insurance application in a shorter form and with prefilled responses (where possible) to make it more likely to be completed. At the end of the process, the customer will be offered multiple affordable and suitable quotes within minutes based on an individualized needs analysis. Figure 4 provides descriptions of these steps.

Step 1. User Interaction

Most millennials are very comfortable using mobile technology for their online interactions, both in the social world of friends as well as the commercial world of transactions. Additionally, they expect to make their own decisions (self-service) and prefer only occasional hand-holding to complete any transaction. So although digital, mobile and online platforms are not currently the dominant channels for most insurers to interact with potential customers, we expect that within the next few years, many life insurers will leverage these platforms as key distribution channels. For example, many life insurance carriers like Massachusetts Mutual Life Insurance Company (Haven Life) and AAA Life Insurance Company have begun offering sales via online and other digital platforms.

Another challenge faced by life insurers is the application format, which today contains upwards of 60 questions covering a variety of individual details along with invasive medical tests and a long wait time of approximately 45 to 60 days.[7] For the millennial and most middle-market consumers, the large number of questions and the time commitment required can be a deal-breaker. From an insurer's point of view, this long-form application is necessary to properly assess the applicant's mortality risk and to prevent anti-selection. However, not all questions in the application questionnaire have the same predictive power. Machine learning techniques can identify the most important features for predicting mortality risk so the least useful features can be removed to simplify the questionnaire. Some insurers are exploring the extent to which the application can be prefilled with data from other internal and external sources. This should make it easier for the consumer who can now focus mostly on correcting any incorrect prefilled information. Additionally, many insurers are

Figure 4
End-to-End View of Accelerated Underwriting Process



beginning to utilize behavioral economics theory in pilot trials to test how rearranging or reframing application questions can improve the veracity of the applicant's responses.[8, 9]

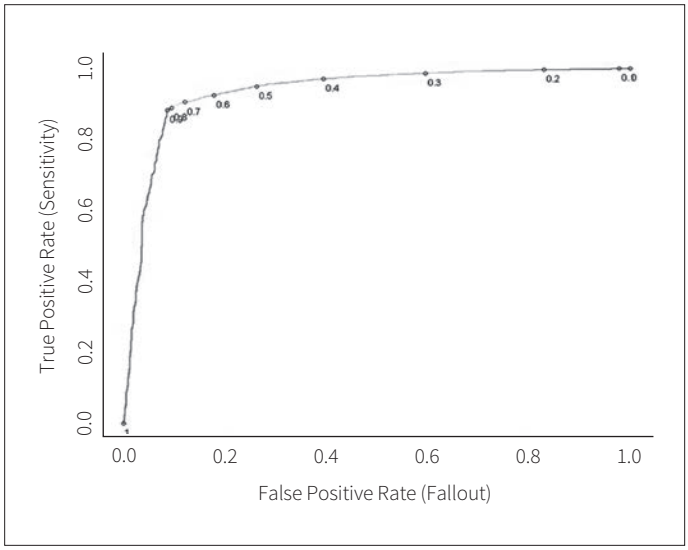
Step 2. Risk Score Prediction

Correctly assessing an individual's mortality risk is critical for the life insurance underwriting process. Traditionally, this assessment has depended on an underwriter reviewing the individual's answers to application questions including family and medical history and the individual's propensity for risk-seeking behavior expressed through hazardous avocations. Additionally, third-party vendors may have provided a proposed insured's prescription profile (Rx), motor vehicle records (MVR) and medical information on major health issues (MIB) that can affect mortality risk. Many life products also require services of paramedical staff to collect fluids and conduct a basic medical exam to assess blood pressure, BMI and pulse. Although this approach has become a standard operating procedure for underwriting many life insurance products, it suffers from both high costs and lengthy time delays, resulting in lower customer satisfaction and higher proposed insured dropout rates. Many life insurers have therefore from our observation started moving toward creating a more customer-centric experience that removes medical exams and fluid-testing for a majority of the applicants. To this end, the use of nontraditional data sources and predictive models are helping better assess an applicant's mortality risk in new ways. Table 1 lists some existing and nontraditional data sources being leveraged for predicting mortality risk in addition to applicant-provided information.

Table 1
Sample Data Elements for Building Mortality Risk-Related Predictive Models

Data Element	Description and Examples	Usage Within Life Underwriting
Third-Party Data	• MIB for medical information • Rx for prescription history • MVR for motor vehicle record	To validate proposed insured's prior medical and insurance purchase history, prescription profile and propensity to take risks (e.g., through review of proposed insured's driving record)
Public Data	• Properties, professional licenses, criminal history	To validate applicant-provided data as well as to fill in missing information
Financial	• Income and employment history • Short-term and long-term debt (mortgage) • Bankruptcies, liens	Used as one of the predictors to predict mortality risk, especially for low-risk individuals
Credit History	• Credit score	Used as one of the predictors to predict mortality risk, especially for low-risk individuals
Digital Imaging	• Facial image analysis	To assess individual's age group, BMI, and smoking status
Social Data	• Publicly available social media such as Facebook, LinkedIn and Snapchat	To verify identity, hobbies, smoker status, and use of alcohol or drugs, although the hit-rate may be low
Population-level Open Data	• Zip code and state-level published data on education levels, median income, disease, risky behavior etc., from sources such as U.S. Census, U.S. Centers for Disease Control • County/state tobacco taxes and regulations	Although coarse in granularity, the data can still be useful to fill in missing data on individuals. The tobacco-related data can be used for smoker propensity prediction
Medical	• Access to electronic medical records	To assess current and future risk related to health and mortality
Health and Wellness	• Vital statistics, heart rate, physical activity data collected from wearables and internet-enabled devices • Food preferences, psychological and emotional health from wellness websites and programs	To assess current and future risk related to health and mortality

Figure 5
Prediction Performance—Comparing True Positive and False Positive Rates



Note: Steep slope of ROC curve indicates model predicts more true-positives with very few false-positives at threshold = 0.8

Step 3. Smoker Propensity Prediction

After age and gender, tobacco usage is the most important determinant of mortality risk and hence of life insurance policy premium. According to the Centers for Disease Control (CDC), overall mortality among both male and female smokers in the United States is about three times higher than that among similar people who never smoked.[10]

In the United States we see actuarial pricing tables routinely load up premium rates to 200 percent, and in some cases well in excess of 200 percent for tobacco users, especially smokers.

Traditionally, presence of cotinine in the blood sample during lab testing has been used to identify tobacco users. However, in the absence of any form of fluid testing within an accelerated underwriting process, one needs alternative approaches to separate tobacco users from nonusers. In today's data-driven world, the use of predictive analytics for identifying smokers and nonsmokers is being actively explored by several insurers. From our experience, the initial results using data-driven approaches look promising, and as shown in Figure 5, the steep ROC curve[11] suggests that the model can correctly predict many true-positives while making few mistakes (false-positives). Since the cost of misclassifying smokers as nonsmokers is much higher than misclassifying nonsmokers as smokers (due to increased mortality cost, and potential lost premiums in the former, and applicant aggravation in the latter), the performance metric that is more relevant is precision,[12] that is, how many predicted true-positives are actual true-positives. The precision requirement, however, is best decided based on calculating the financial impact of misclassification error, by conducting a cost benefit analysis.

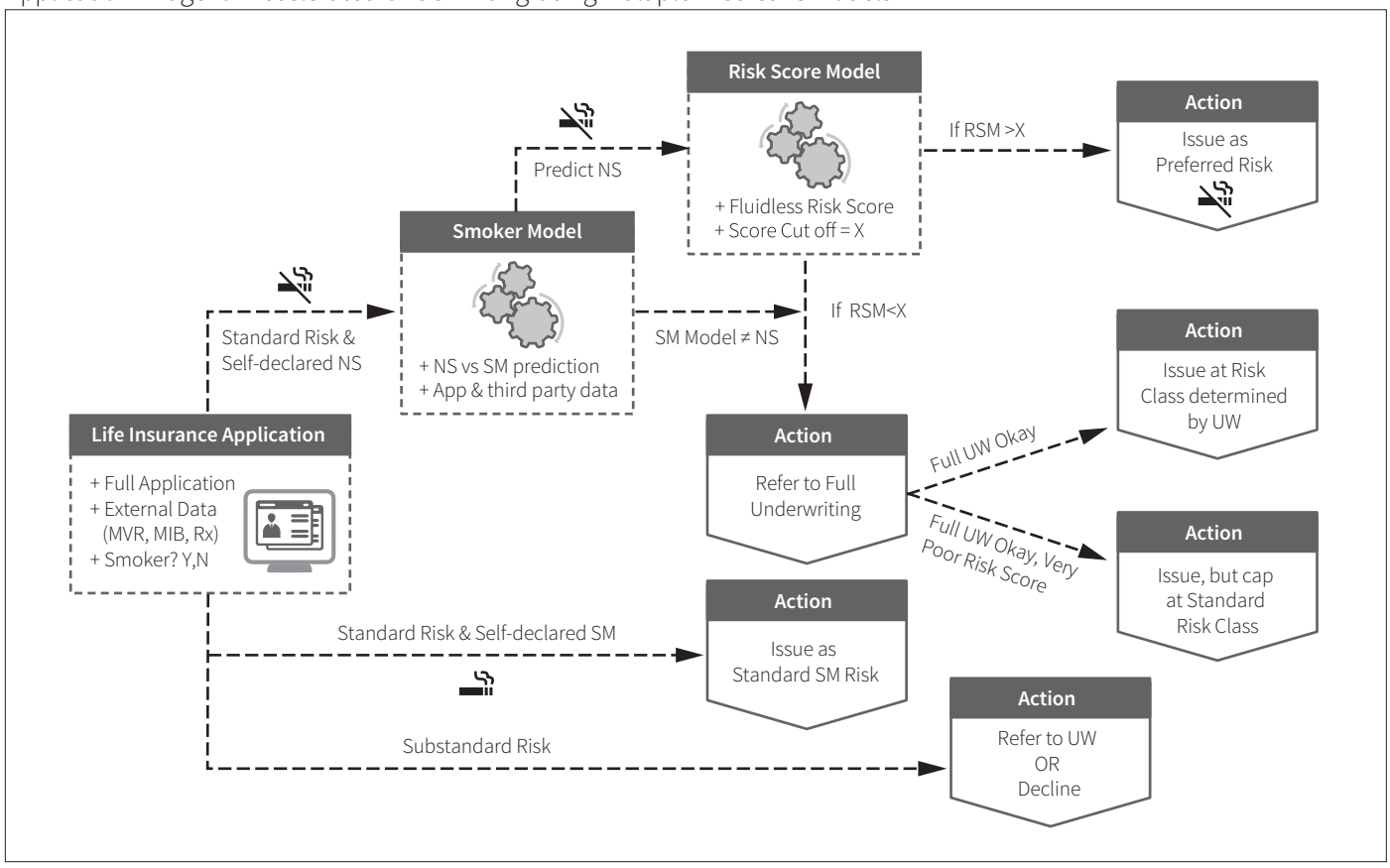
Step 4. Rule-Driven Application Triage

The vision of having an end-to-end, fully automated, data-driven approach to underwriting is appealing, but many companies would prefer to evolve in a more nuanced and deliberate way. Many are exploring alternative business processes whereby the output of a predictive model feeds into a triage step. Predicted low-risk applicants can then proceed ahead through the fast-track process, while the predicted high-risk applicants are asked to proceed via the traditional process. Subject to regulatory guidance, there could be multiple types of triage scenarios for fully underwritten products. Figure 6 shows an example of a multistep triage approach designed to direct applicants to the next step in the end-to-end accelerated underwriting, based on their risk rating and their predicted smoker/nonsmoker status. The figure illustrates the sequence of applications and third-party databases used to triage applications in preparation for assigning them to a risk class.

Step 5. Risk Classification Using Risk Score Thresholds

There are two approaches to predicting the mortality risk of a proposed insured applicant by using a risk score: either use the score to predict the risk class that would have been assigned by an underwriter, or use the score to predict the expected mortality, which can then be converted into an appropriate risk class.

Figure 6
Application Triage for Accelerated Underwriting Using Multiple Predictive Models



Generally, the first approach is easier to sell to the underwriting community; however, the second approach is a more objective way of assessing a proposed insured's mortality risk.

We note that when validating the predicted risk class against the historical underwriter-derived risk class for an application, the predicted risk class could be different from the underwriter's decision. The movement of applicants across risk classes is most common for those applicants whose scores are near the borderline between two classes. However, the objective measure should be the relative actuals-to-expected (A/E) mortality ratios for various risk classes, where the better underwriting risk is represented by a lower A/E ratio. During deployment of a risk scoring solution, the choice of associating risk classes with risk score intervals is very much left to the insurance company but can be selected based on comparable A/E ratios for the risk class and corresponding risk score interval.

Step 6. External Rules Engine

The data-driven predictive analytics approaches address the risk score prediction and tobacco usage prediction in steps 2 and 3 respectively. Before the introduction of new predictive analytics techniques, the most common approach to underwriting decisions had been the use of experience-based rules that resulted from several proprietary and industry-sponsored research studies. These rules generally apply an extra loading for mortality-increasing risk factors within the preferred criteria. Examples of such risk factors include family history of significant illnesses of either parent, participation in hazardous avocations, just to mention a few. The rules engine sums up the total risk factor loading for a proposed insured, which is then compared against a table to assign a risk class. From this perspective, the external rules engine can complement the predictive models with experience-based rules to further refine the risk class assigned to an applicant. So it is not surprising that many insurers require that decision rules for underwriting be included within their end-to-end accelerated underwriting process.

Step 7. Mortality-Risk-Based Pricing Algorithms for Quote Generation

Although the details of mortality-based pricing models are outside the scope of this article, many insurers use pricing tables based on age, gender, risk-class and tobacco usage of an individual to compute the premium for life insurance policies of

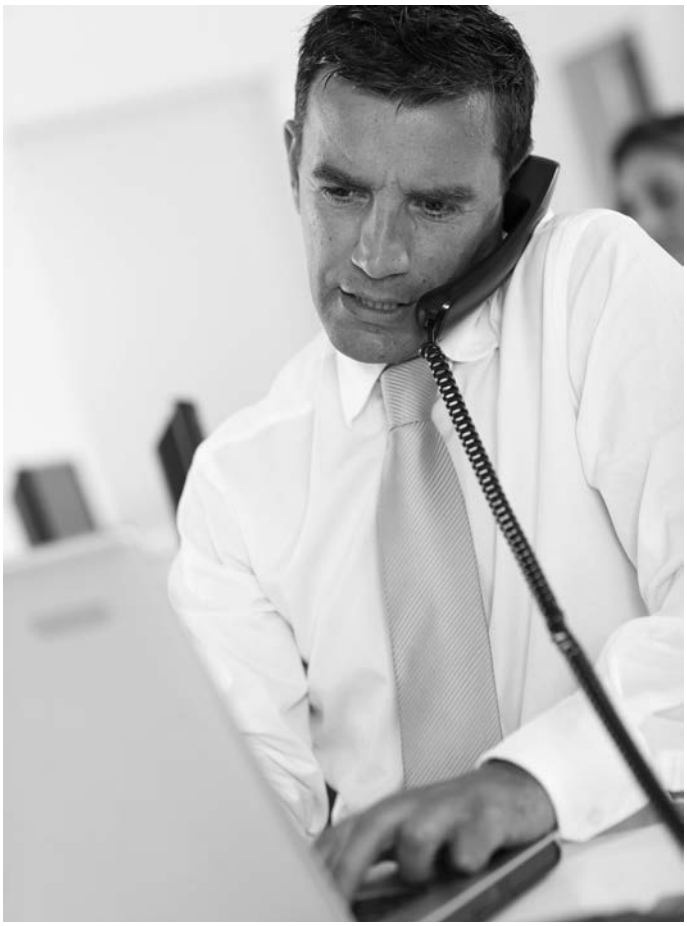
specific face amount and level term periods (for term products). The process flow as described in Figure 4 essentially provides these variables required by the mortality-based pricing algorithm to support a real-time quote. A useful feature can be to compute prices for multiple combinations of face amounts and term periods, based on historical choices made by other users, with situations similar to the applicant. These multiple pricing options can then be presented to the customer as described in Step 8, to help make a life insurance buying decision that best suits his or her situation.

Step 8. Real-Time Customer Response

In responding to a customer's request for a life insurance policy, the goal should be more than just fast response time. In addition to providing a quote in real-time for the face amount requested, it would also be helpful to offer assistance to the customer to make a buying-decision. If viewed from this perspective, the process could also include:

- Providing various alternative solutions that cover not just the requested face amount and term period but also other face amounts and term period combinations, in case the requested coverage is beyond the customer's financial reach.
- Providing an alternative life insurance product to the customer, should the customer not qualify for the original coverage requested.
- Illustrating how each offered policy provides coverage for various adverse life events that the individual could face besides the ultimate death benefit, in the form of life insurance riders relevant to their situation. This should help the customer to better understand the complete benefits offered and thus optimize the potential to complete the sale.

> … continuous improvements in the prediction accuracy of new analytics approaches/models should allow insurers to offer coverage using accelerated underwriting programs for higher face amounts and at premium rates closer to fully underwritten products.



- Providing an overview of life insurance products and coverage that "people like me" have purchased, with a corresponding distribution of such product purchases by age, gender and location. This again should help increase the customer's confidence about their buying decision.

Step 9. Traditional Underwriting of Selected Applicants

Assuming the issuing carrier meets all regulatory requirements in the relevant jurisdictions, steps 1 through 8 provide an overview of an accelerated underwriting process that could work for a significant portion of applicants who pass the required database checks as well as various cutoff thresholds set for the predictive models, depending on the pricing goals of the company. However, there will be situations that are difficult to resolve through the fast-track process, such as when an applicant has poor scores from the risk score prediction model or the smoker prediction model warrants further investigation. These situations should result in the applications getting redirected out of the triage process (as shown in Step 4), to go through the traditional underwriting process, wherein an underwriter can review and assign the appropriate risk class to the applicant.

CONCLUSION

One can argue that underwriting has always been data-driven with application details, lab and examination results, and vendor data feeding into the underwriting process implemented through a set of rules and supported by an underwriter's judgment. In that sense, advances in underwriting are not as much about being data-driven as they are about leveraging advanced analytics or machine learning techniques,[13] and nontraditional data sources to assist with mortality prediction. The promise of advanced machine learning models is to be able to predict tobacco usage and mortality risk score for all proposed insureds at levels of accuracy rivaling human underwriters.

Currently, insurers offering instant issue life insurance products with no human in the loop are limited to simplified-issue products. To address veracity concerns posed by less-than-truthful applicants, these products mostly mitigate risk by limiting coverage to lower face amounts and at premium rates higher than traditional, fully underwritten products. We believe that continuous improvements in the prediction accuracy of new analytics approaches/models should allow insurers to offer coverage using accelerated underwriting programs for higher face amounts and at premium rates closer to fully underwritten products. In our view, prediction accuracy of current state of the art models is acceptable for proposed insureds who have inherently low to medium mortality risk. Nonetheless, this group is a significant part of the applicant population and so insurers can still realize significant benefits by implementing current state of the art models. For the remaining medium- to high-risk individuals who traditionally have been processed by human underwriters, a simplified issue product or a rated product determined by an underwriter should address the current prediction accuracy gap.

As successful as the initial foray into this pattern-based predictive analytics approach has been, it is still evolving. However, we have no doubt it will find its place in life insurance underwriting, especially as these analytics approaches are refined in accordance with developing regulatory guidance. ■

Nitin Nayak, Ph.D., is VP & senior analytics professional at Swiss Re. He can be reached at *nitin_nayak@swissre.com.*

Stephen Abrokwah, Ph.D., ASA, CERA, MAAA, is AVP & marketing actuary at Swiss Re. He can be *reached at stephen_abrokwah@swissre.com.*

ENDNOTES

1 *The US Mortality Protection Gap–An update*. Milka Kirova, Swiss Re Economic Research & Consulting, August 2015, *http://institute.swissre.com/research/overview/insurance_monitoring/the_US_mortality_protection_gap_an_update.html*.

2 Measured as the difference between the amount of coverage held by individuals or households and the optimal amount cover needed in the event of the demise of the breadwinner of a household.

3 *Mortality Protection Gap in the US*. Swiss Re Economic Research & Consulting, 2012, *http://www.swissre.com/library/publication-sigma/The_mortality_protection_gap_in_the_US.html*.

4 Individual life insurance sales drop and distribution of life products has shifted from mid-market to high net-worth individuals.

5 *Simplified Issue and Accelerated Underwriting*. The Society of Actuaries and the American Academy of Actuaries, 2016, *https://www.actuary.org/files/publications/SI_AUW_LATFPresentation_12.8.2016.pdf*.

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9 *How Using Behavioral Economics Can Improve Underwriting Results—Risk Insights*. Marchy Updike, GenRe, January 2017, *http://www.genre.com/knowledge/publications/ri17-1-en.html*.

10 *The Health Consequences of Smoking—50 Years of Progress. A Report of the Surgeon General*, U.S. Department of Health and Human Services. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.

11 The graph in Figure 5 is called a receiver operating characteristic curve (ROC curve). It is a plot of the true-positive rate against the false-positive rate and shows the tradeoff between sensitivity and specificity for different possible cutoff points. The area under the ROC curve is a measure of predictive model accuracy. The closer the curve is to the top-left corner, the more accurate the predictive model, while the closer the curve comes to the 45-degree diagonal of the ROC space, the less accurate the predictive model.

12 Precision (also called positive predictive value) is the fraction of predicted positive instances that are correct. A perfect precision score of 1.0 means that every predicted positive instance is correct prediction.

13 In this regard, enabling all insurers to capture application data in digital format should be high on the priority list of both life insurers and industry consultants.

Impact of VM-20 on Life Insurance Product Development—Phase 2

By Paul Fedchak, Jackie Keating, Karen Rudolph, Uri Sobel and Andrew Steenman

The Society of Actuaries' (SOA) Product Development Section, Smaller Insurance Company Section, Reinsurance Section and the Committee on Life Insurance Research engaged Milliman to examine the impact of the new reserve standard for the product development actuary. The research is organized in two phases. The objective of Phase 1 was to investigate the changes to the product development process as a result of VM-20 through the development of case studies for term and universal life with secondary guarantees (ULSG) products.

Phase 2 of the research expands on the Phase 1 case studies and includes additional case studies focused on smaller companies and the impact of reinsurance. Phase 2 also discusses the industry's preparedness for pricing under VM-20 and identifies pricing and product design issues through interviews and discussions with product development actuaries.

This article highlights some key excerpts from Phase 2 of this research. Phase 1 was addressed in an article in the June 2017 issue of *Product Matters!* For the sake of brevity, certain details of the research have been omitted from this article. Please reference the research report (*https://www.soa.org/research-reports/2016/2016-impact-of-vm20-product-development/*) for a complete description of our methodology.

SMALL COMPANY CASE STUDIES

The Phase 1 case studies reflected characteristics of a large company in that the mortality experience was assumed to be fully credible, with a 15-year Sufficient Data Period (SDP). Fully allocated expense factors were in line with large company profiles, and the company wrote enough business to justify financing excess statutory reserves. This Phase 2 small company sensitivity presents the situation for a small company by changing relevant assumptions and demonstrating the impact on VM-20 pricing for term insurance and ULSG.

Term Small Company Case Study

Figure 1 outlines the stepwise assumption changes from Phase 1 Situation 5 to the Phase 2 small company sensitivity for term. Phase 1 Situation 5 is the pricing situation in which VM-20 statutory reserves are used based on an NPR component using the 2017 CSO Table, and DR and SR following VM-20 requirements. Tax reserves are calculated as the NPR using 2017 CSO table. The bolded item is the change for each step.

Starting with the Situation 5 pricing results from Phase 1, Figure 2 shows the pricing results of the stepwise implementation of each of the characteristics noted previously. We performed the study on four term product varieties—a 10-year and 20-year level term period on both a low band ($350k) and high band ($1.2M) face amount. The results for the 20-year term, high band model office are shown in Figure 2. Each row of the table includes the changes in the preceding steps.

Changes observed in Figure 2 include the following:

1. Step 1 drives profitability lower by introducing additional Year 1 expenses. In all four term product varieties in this

Figure 1
Term Small Company Assumption Changes

Step	Acquisition Expense per Unit	Mortality Credibility and Sufficient Data Period	Reinsurance
Phase 1	$0.20	100% and 15 years	Non-Guaranteed YRT, $1,000,000 Retention
Step 1	**$1.00**	100% and 15 years	Non-Guaranteed YRT, $1,000,000 Retention
Step 2	$1.00	**28% and 3 years**	Non-Guaranteed YRT, $1,000,000 Retention
Step 3	$1.00	28% and 3 years	**80% Coinsurance with $100,000 limit on retention Expense allowances are 100% first year, 11% renewal years**

Figure 2
Pricing Results—Small Company—20-Year Term

Small Company 20-Year Level Term	Pretax Profit Margin[1]	After-Tax Profit Margin[2]	Adjusted After-Tax Profit Margin[3]	Surplus Strain	IRR Adjusted After-Tax
High-Band Model Office					
Phase 1 Situation 5	19.9%	11.9%	6.7%	−147%	10.4%
Step 1: Increase Per Unit Acquisition to $1.00	14.7%	8.5%	3.3%	−178%	7.1%
Step 2: Inner Loop Mortality 28% Credibility; Three-Year SDP	14.7%	1.0%	−4.5%	−472%	4.2%
Step 3: Coinsurance	8.1%	1.9%	−0.5%	−75%	4.5%

[1] Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER).
[2] After-tax profit margin is calculated with discount at the pretax NIER.
[3] Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.

case study, this increases surplus strain, reduces profit margin metrics and reduces IRR.

2. Step 2 changes the level and pattern of VM-20 statutory reserves because the Deterministic Reserve (DR) is affected by the much lower credibility measurement and shorter SDP of the smaller company sensitivity. Because the pre-tax profit margin is discounted at the pre-tax NIER, the pre-tax profit margin does not materially change, while other profit metrics are reduced due to the additional reserve margins.

3. Step 3 reflects the implementation of a coinsurance agreement that small companies might consider to lower surplus strain. Coinsurance changes the shape of the profit pattern by reducing the surplus strain (increasing first year profits) and reducing renewal profits. For the 20-year plan $1.2M policy size, the after-tax profit margins and IRR are higher than for Step 2 because after coinsurance is implemented, the tax basis reserve is equal to the statutory basis reserve for all but the latest durations, whereas for the Step 2 situation, the statutory basis reserve was considerably higher than the tax basis reserve.

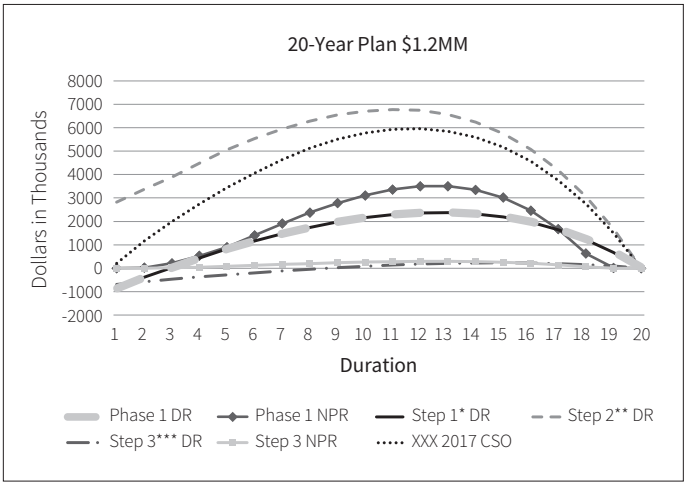
In this small company sensitivity, reserve relationships change from the Phase 1 case studies. This section looks at the change in reserves under each of the steps implemented for the small company sensitivity.

- Step 1 does nothing to change the Net Premium Reserve (NPR) or DR, because acquisition costs are assumed to be incurred at time of issue and are not included in the cash flows for the DR forecast for the end of the first year.

- Step 2 illustrates the impact of lower mortality credibility and shorter SDP. The NPR for Step 2 is the same as the Phase 1 NPR, because mortality credibility and SDP do not impact the determination of the NPR. The characteristics of less credible mortality experience and shorter SDP for the smaller company increase the Step 2 DR as compared to the Phase 1 (and, as noted above, the Step 1 DR) higher credibility DR. In fact, under these conditions, the Step 2 DR is as great as, or greater than, XXX method reserves in many durations for each of the four term product varieties.

- Step 3 is where 80 percent coinsurance with a $100,000 limit on retention is implemented. Because the majority of the risk is now ceded away, and a coinsurance expense allowance becomes part of the DR cash flows, the level of

Figure 3
Reserve Levels—20-Year Term, High-Band



* Step 1: Higher Acquisition Expenses
** Step 2: Lower Mortality Credibility
*** Step 3: Coinsurance

the DR changes in a material way. The NPR is affected as well, because the NPR needs to allow for only the insurance amount retained.

Graphs of all the reserve streams for the 20-year plan, high band are shown in Figure 3. In these graphs, the DR is unfloored, consistent with the graphical presentations of DR in Phase 1.

ULSG Small Company Case Study

Figure 4 shows the stepwise results from Phase 1 to the Phase 2 small company sensitivity for ULSG. The small company assumption changes are the same as shown for term except that the acquisition expense step is not shown, because its impact was minimal relative to the following two steps.

Changes observed in the projections summarized in Figure 4 include the following:

- Moving from Phase 1 Situation 5 to the Step 2 small company assumptions increases the DR, resulting in considerable additional surplus strain and noticeably lower profit margins.
- The Step 3 reflection of coinsurance reduces surplus strain considerably. For Step 3, the impact to IRR is noticeably different between the low band and high band products that were tested. The DR per unit of face in the high band is less than in the low band because the coinsurance allowance is the same, while the high band has a higher ceded percentage but lower expenses to cover (as a percent of premium). As a result, the low band experiences only a modest IRR increase, while the high band shows a considerable increase in IRR.
- The impacts on profit margins in the high band and low band are more similar than the IRR impacts, indicating that the IRR is a more sensitive profit measure at the lower retained amounts in these studies.

GUARANTEED YRT CASE STUDIES

The purpose of this sensitivity is to examine the potential impact to pricing results should the YRT reinsurance agreement guarantee the YRT premium rates. The following details provide additional context to understand the sensitivity.

- The Phase 1 Situation 5 reflects nonguaranteed yearly renewable term (YRT) reinsurance on insurance amounts in excess of a $1,000,000 retention limit, with YRT premiums set at 110 percent of the pricing mortality.
- For the Phase 1 DR and SR calculations, YRT premiums are 110 percent of the VM-20 mortality assumption. For the Phase 1 case studies, we did not assume any delay in the reinsurer's premium increase.
- We ran this Phase 2 case study for high band ($1.2M Face Amount), and the retained amount is assumed to be reduced to $200,000 to better observe the impact.
- The final change made within this sensitivity is to test the impact of setting the guaranteed YRT rates at specified levels. For term, we ran sensitivities assuming YRT premiums equal to 115 percent and 120 percent of expected mortality. For ULSG, we ran only a sensitivity assuming YRT premiums equal to 120 percent of expected mortality. These are illustrative only and not indicative of the level of rates that would be available in the market.

Figure 5 provides the pricing result for this series of runs for the ULSG case study.

In moving from Situation 5 from the Phase 1 report to the Revised Baseline with $200,000 retention:

Figure 4
Pricing Results—Small Company—ULSG

Small Company ULSG	PT Profit Margin*	AT Profit Margin**	Adjusted AT Profit Margin***	Surplus Strain	IRR Adjusted After-Tax
High-Band Model Office					
Phase 1 Pricing Situation 5	19.5%	4.4%	2.6%	−285%	5.9%
Step 2: Small Company Acquisition and Reserve Assumptions	18.5%	−1.1%	−3.0%	−503%	4.9%
Step 3: Small Company with Coinsurance	4.9%	2.5%	2.3%	−31%	13.4%

*Pretax profit margin is calculated with discount at the pretax NIER.
**After-tax profit margin is calculated with discount at the pretax NIER.
***Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.

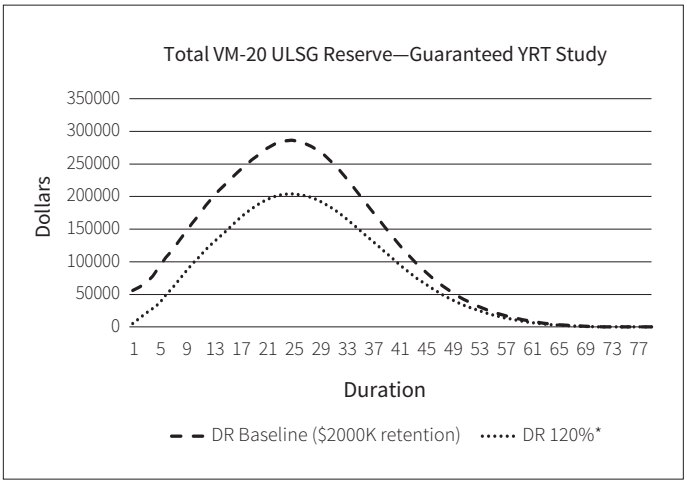
- Surplus strain is increased because reinsurance has a net cost, and the net cost of ceding additional business is reflected in the initial DR and SR.
- Increased investment income on the higher reserve levels helps offset the total impact, but profitability is still down across all measures due to the additional cost of ceding the business.
- The long-term nature of ULSG results in considerable long-term DR and SR mortality margins (in particular, assuming no mortality improvement beyond each valuation date), which are reflected in the nonguaranteed YRT rates in Phase 1. Guaranteeing the YRT rates effectively removes these considerable margins from the DR and SR calculations, so the IRR impact of the 10 percent increase in YRT premium compared to Phase 1 is more than offset by the reserve relief due to the guaranteed YRT rates.

Moving from the revised baseline to YRT premiums guaranteed at 120 percent of best estimate mortality, profitability improves considerably. The increase in YRT premiums on its own decreases profitability, but it is more than offset by the decreased reserve strain realized by not including margins on the YRT reinsurance premiums. The profit margins are increased marginally, but the decreased surplus strain results in considerably higher IRRs.

Figure 6 shows the VM-20 reserve on the revised baseline compared to the guaranteed YRT premium situation for the high-band ($1.2M) product. The total reserve continues to be driven by the DR with a small excess SR.

We performed the same sensitivity for term. For the term products, there was a tension between the cost of the assumed increase in YRT premiums versus the impact of the guaranteed premiums on the VM-20 reserves, producing varying impacts on profitability and depending on the product and profit metric under consideration. For the ULSG block, the increase in YRT premiums on its own decreases profitability, but it is more than offset by the decreased reserve strain realized by not including margins on the YRT reinsurance premiums.

Figure 6
Reserve Levels—Guaranteed YRT—ULSG



* 120%: Guaranteed YRT Premiums Equal to 120% of Expected Mortality

INDUSTRY INTERVIEWS

Background

An element of this phase of our research involved interviews with company actuaries within the industry who are, or will be, involved in the real-life exercise of pricing and product development in the context of VM-20.

Figure 5
Pricing Results—Guaranteed YRT ULSG, High-Band

Guaranteed YRT ULSG	PT Profit Margin*	AT Profit Margin**	Adjusted AT Profit Margin***	Surplus Strain	IRR Adjusted After-Tax
High-Band Model Office					
Situation 5 from Phase 1 Report	19.5%	4.4%	2.6%	−285%	5.9%
Revised Baseline with $200,000 Retention	14.0%	−2.6%	−4.2%	−393%	4.6%
YRT Premiums at 120% of Expected Mortality	10.1%	4.9%	3.7%	−64%	13.9%

*Pretax profit margin is calculated with discount at the pretax net investment earnings rate (NIER).
**After-tax profit margin is calculated with discount at the pretax NIER.
***Adjusted after-tax profit margin includes target capital effects and is calculated with discount at the pretax NIER.

We spoke to actuaries at 14 companies of varying size that issue individual life business. For most of the conversations, several company actuaries participated. While the focus of the discussions was on pricing and product development, actuaries from valuation, corporate and modeling areas were often part of the conversations as well. For some small companies, these duties were represented by the same person.

In the following sections, we summarize the main findings from these interviews, categorized as follows:

Preparedness

- There was an even mix between the pricing and valuation areas regarding where VM-20 expertise resided, and which area leads or led the effort to be VM-20-ready. Generally, companies that had executed or worked on reserve financing transactions were more prepared than companies that had not, and at those companies, the VM-20 knowledge in the valuation area was ahead of the pricing area. On the flip side, at companies that were looking to roll out VM-20 products in 2017 or early 2018, the pricing area led the learning curve. In companies where the corporate structure was organized across product lines rather than function, term was generally more VM-20-ready than ULSG.

- Most of the companies had done some form of VM-20 trial run, regardless of the company's timeline for moving to VM-20 reserves. In some cases, those were purely valuation exercises, and in other cases, they were more pricing-focused. Generally, companies expect their term business to pass the Stochastic Exclusion Test (SET).

- While some companies are planning to roll out products priced on a VM-20 basis in 2017 or early 2018, most companies are planning to wait until the end of the three-year transition period. Generally, companies expected to price and offer a VM-20 term product before ULSG. The pricing timeline is a factor in these roll-out plans; companies indicated a need to reprice multiple products by the end of the transition period.

Concerns and Issues Regarding VM-20 Implementation

Fluctuation in Reserve Levels

- Many companies expressed concern over a now higher level of unpredictability and fluctuation in their reserves and anticipated profits under VM-20. This was regarding both the impact of unlocking assumptions (in particular, the interest assumptions) and potential regulatory changes in VM-20 methodology. There was consistent concern among interviewees regarding the future definition of tax reserves. One participant commented on the positive side of these fluctuation issues, in that it will allow for faster reactions or corrections than in the past.

Limited Guidance

- There was some concern regarding limited guidance within VM-20 and related PBR literature on appropriate assumptions, margin setting and covered risks (e.g., conversion privileges). This was true in general, and particularly regarding assumptions for new underwriting regimes with limited experience (e.g., accelerated underwriting).

Complexity

- More than half the participants raised concerns regarding the intensiveness and complexity of the computations necessary for VM-20. While most companies expressed satisfaction with their actuarial modeling system, it was clear that a significant effort needed to be exerted to make the systems VM-20-ready, either through customized coding, learning to use the VM-20 features or upgrading systems to take advantage of VM-20 capabilities. Other concerns around complexity included the following:

  - Extensive runtime, particularly for stochastic calculations
  - Separate assumptions for inner-loop versus outer-loop projections
  - Auditability of projected VM-20 calculations
  - Coordinating between use of multiple systems (e.g., one system to calculate the NPR, and another to calculate the DR and/or SR)
  - Moving to an asset/liability pricing approach versus a liability-only approach

- A couple of companies expressed concern that moving to VM-20 would slow the speed at which they can bring products to market. However, they also thought the increase in time-to-market would be highest at first, but over time, while it still may take longer to introduce a new product than it does now, it would not take as long as for the first VM-20 products the company introduces.

Profitability

- Several companies commented on lower anticipated profitability upon moving to VM-20 reserving. This was particularly true for small companies with limited or near-zero mortality credibility, as well as for companies already engaged in reserve financing.

Collaboration and Coordination Between Functional Areas

Almost universally, companies indicated that VM-20 will increase collaboration, cooperation and communication between areas of the company, primarily the pricing and valuation areas, but also the modeling, corporate and tax areas as well. There was general agreement that assumptions should be the same, at least initially, in the reserve calculations performed in these areas.

- For about half the participants, the increased collaboration, cooperation and communication were facilitated by regularly scheduled meetings. Some companies even formed separate VM-20 task forces with representation from various company departments. In other cases, this was handled on a more informal basis.

- A common theme we heard was that companies were already planning to further improve and formalize their existing governance and collaboration structures, particularly in the areas of model control and assumption ownership. The operative date of VM-20 has encouraged and accelerated implementation of those plans. Small companies as well as a couple of larger companies have used outside consulting assistance in developing these governance and collaboration structures. A few companies are at a stage where they are deliberating what the new structures should be and which areas would be responsible for each element of the VM-20 process. There was a wide spectrum in the level of formality around these governance structures.

Changes to Pricing Process and Product Design

Pricing Process

Nearly all interviewees expressed the opinion that the pricing process would involve the same basic steps under VM-20 as currently. However:

- Almost all companies interviewed acknowledged that VM-20 would initially slow the pricing process, but companies differed in their opinions regarding how much that would continue to be the case in the future. Items cited as contributing to the increased time to market included:
  - Increased collaboration and communication between company areas and other parties (e.g., reinsurers, regulators)
  - Deliberations regarding uncertainty in various aspects of the VM-20 calculations
  - Increased model runtime
  - More sensitivity testing
  - Increased number of calculations to validate
  - Updating to a new CSO table simultaneously with moving to VM-20

Changes in Product Design

While most companies acknowledged that there could be reasons to change their term or ULSG product designs under VM-20, few interviewees indicated they had worked through the details of changing product design under VM-20. Most companies were taking a "wait-and-see" approach.

Reinsurance in VM-20 Context

Most companies were at a beginning stage of thinking about how their use of reinsurance may change under VM-20. Some companies described themselves as listening to reinsurers' thoughts and waiting for ideas from the reinsurers.

- A few companies mentioned the possibility of looking for reinsurance rate guarantees.

- There were some discussions regarding reinsurers helping companies increase the credibility of their mortality assumption (and therefore lower margins), but almost no concrete plans in that regard. This was especially true regarding mortality for new underwriting regimes such as accelerated underwriting.

- There was a mix of opinion regarding whether reinsurer input would be sought toward the end of the pricing process, or whether it would be earlier, more frequent and potentially an iterative element in the pricing process.

- There were few substantive comments regarding the company's use of reserve financing on new issues once VM-20 was implemented within a company, though some companies indicated they would evaluate the possibility later.

Product Lines Other Than Term and ULSG

- In our discussions, companies generally indicated their plates were full enough regarding Term and ULSG, and that they have not given much thought to other products in a VM-20 context.

As this is a new frontier within the industry, it will be fascinating to watch how pricing actuaries' thoughts and reactions to VM-20 change in the next few years.

OTHER CASE STUDIES

The Phase 2 report addresses a handful of case studies in addition to those previously described. These additional case studies include:

- An attribution analysis of the margins on the Phase 1 Situation 5 Deterministic Reserve
- Analysis of 10 years of post-level term cash flows
- A single cell of a simplified issue product
- A 30-year level premium term single cell
- A short-pay ULSG single cell study

Some of the key conclusions from these additional cases studies are summarized as follows.

- When we analyzed the factors contributing to the excess of the DR over a best estimate gross premium reserve for the Phase 1 VM-20 case studies (Situation 5), we found that for both term and ULSG, moving from anticipated experience mortality to VM-20 mortality assumptions had the most significant impact on the level of reserve.
- Under the case study of specified post-level term assumptions, the post-level term period cash flows are clearly beneficial to the profitability metrics.
- For a company issuing a term product under a simplified issue (SI) underwriting program, the single-cell example in this report indicated that the adoption of VM-20 reserving methods together with current expectations for policy size and premium amounts imply a similar and perhaps improved IRR when compared to the IRR under Model 830 reserving methods. However, this outcome is dependent upon the chosen VM-20 assumption set, product design and premium levels.
- For the 30-year term single cell, the tax impacts together with the reduction in reserve requirements and material surplus relief make for a significant increase in profitability under VM-20.
- For the ULSG product, the case study indicated that a 10-pay premium pattern is less profitable than the level-pay situation, but the single-pay is more profitable. The higher single-pay profitability is driven largely by the initial strain, which is quite small in the single-pay situation. The reduced initial strain in the single-pay case is largely due to the commission level relative to the initial premium, which is a phenomenon not unique to a VM-20 pricing situation. ■

Paul Fedchak, FSA, MAAA, is principal and consulting actuary at Milliman. He can be reached at *paul.fedchak@milliman.com*.

Jackie Keating, FSA, MAAA, is principal and consulting actuary at Milliman. She can be reached at *jackie.keating@milliman.com*.

Karen Rudolph, FSA, MAAA, is principal and consulting actuary at Milliman. She can be reached at *karen.rudolph@milliman.com*.

Uri Sobel, FSA, MAAA, is principal and consulting actuary at Milliman. He can be reached at *uri.sobel@milliman.com*.

Andrew Steenman, FSA, MAAA, is a consulting actuary at Milliman. He can be reached at *andrew.steenman@milliman.com*.

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How Do You Bring New Insurance Products to Market?

Five Insights from the Society of Actuaries Product Development Survey

By Donna Megregian

Past success doesn't guarantee ongoing success, particularly when it comes to insurance product portfolios. Today's evolving insurance landscape has made new product development vital to insurers' financial strength and business growth. At a time of changing customer demand, regulatory standards, and market pressures, how do insurers bring successful new products to market?

After two years in the making and more than 3,700 data points analyzed, a far-reaching product development survey conducted by RGA and LIMRA on behalf of the Society of Actuaries (SOA) sheds new light on how individual life and annuity insurers are evaluating this question. RGA and LIMRA collaborated on this study to explore product development practices in the United States and Canada adding some global markets perspectives for the SOA. The survey findings provide an effective tool for insurers to benchmark performance, identify common challenges and seek areas for improvement, growth and/or investment.

The following are just a handful of insights from the over 200-page analysis; readers can access the overview and full report on the SOA website.[1]

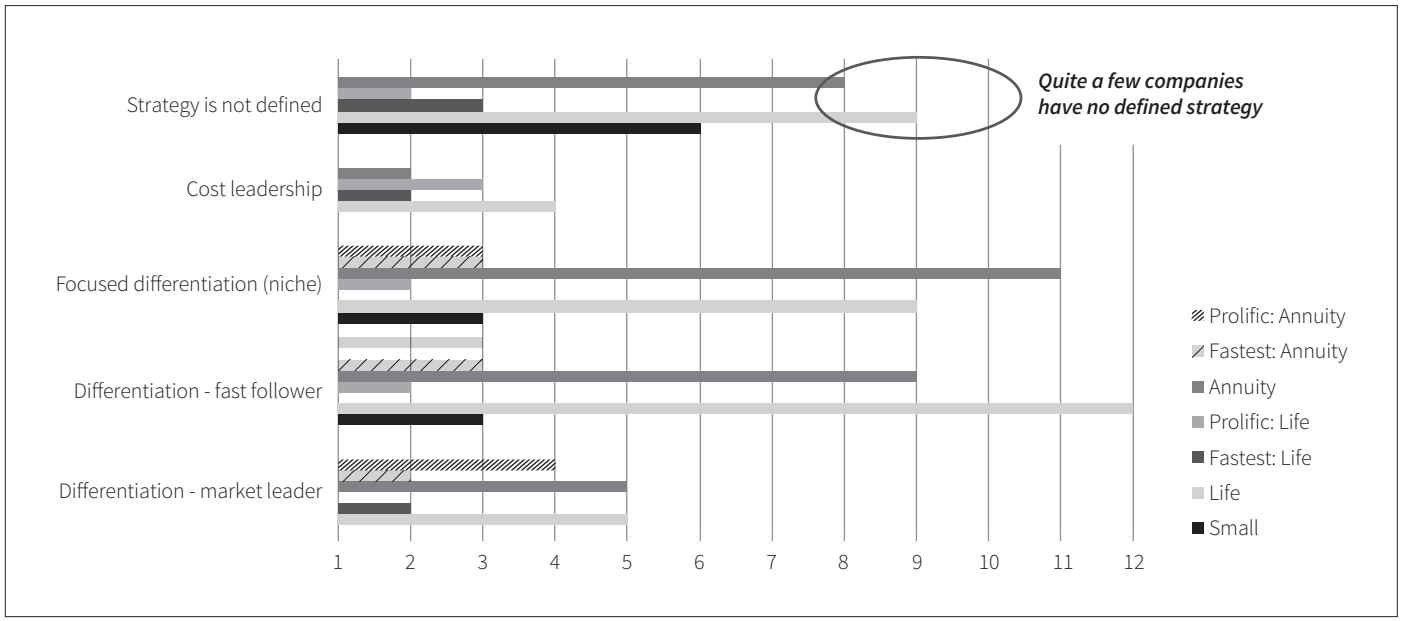
1. FAST FOLLOWERS OUTNUMBER FIRST-TO-MARKET INNOVATORS.

We're probably a fast follower like a lot of companies. But on the other hand, we do have some innovative things that we have done… It just takes more money and more time to do things in today's market environment than it took us 10 years ago. See Figure 1.

Many insurers acknowledge they do not have a clearly defined strategy for product development, but this does not necessarily hinder the entire product development process. For example, the undefined strategy companies do not report launching fewer products. Those companies with a defined strategy most frequently embraced fast-follower or niche approaches. Fast followers avoid the investment and risk of first-to-market innovation, but must work quickly to react to changes in the market and seek to improve on the design being followed. Fast follower companies may not consider themselves highly innovative, nor do they make disruptive innovation a measure for success.

Figure 1

Which of the following best describes the primary focus of your organization's life insurance product development strategy?



2. GREATEST NEED FOR IMPROVEMENT: ADMINISTRATION.

We always complain about the IT capacity. I think our company really made a great stride in recent years. See Figure 2.

The top area identified as needing improvement was administration; however, most insurers have taken little action in the last two years to improve this significant bottleneck (p. 74). If budgets permitted, hiring staff and upgrading technology are ideal goals (B16), but many companies struggle to achieve them. Some have realized efficiencies in their process by outsourcing (D1a and D2a).

3. SPEED MATTERS, BUT IT MAY NOT BE EVERYTHING.

We don't necessarily want to set a date 12 months ahead of time and crunch to get it. We'd rather set the priority, get the proof of concept, get the work done, and then as we get closer, start to finalize that date for all the planning. See Figure 3.

Faster companies are able to shave off weeks, even months, from certain product development efforts (pp. 133–154). Insurers that navigate the development process faster tend to begin steps much sooner and alongside other steps, without waiting for completion of one task to move on to potential dependent tasks. For them, items like rider development and reinsurance start earlier in the overall process than at other providers. However, the most respected companies are not necessarily the fastest, and tend to spend more time in pricing and marketing than other insurers.

> The survey findings provide an effective tool for insurers to benchmark performance, identify common challenges and seek areas for improvement, growth and/or investment.

4. LEVERAGING PREDICTIVE MODELING IS MOST KEENLY BEING SOUGHT THROUGH UNDERWRITING.

We have a [predictive modeling] team. They don't really work that closely with us yet…We're starting to talk more about how we tie into the broader data and analytics team. See Figure 4.

While currently used more in the marketing space, almost 70 percent of companies indicated they are exploring predictive modeling in the area of automated, simplified or accelerated underwriting. This highlights the link to increased customer satisfaction, and where market leaders and fast followers are spending a great deal of time. Blending with marketing plans based on predictive modeling's ability to identify consumer

Figure 2
How important are the following to your organization's current product development strategy?

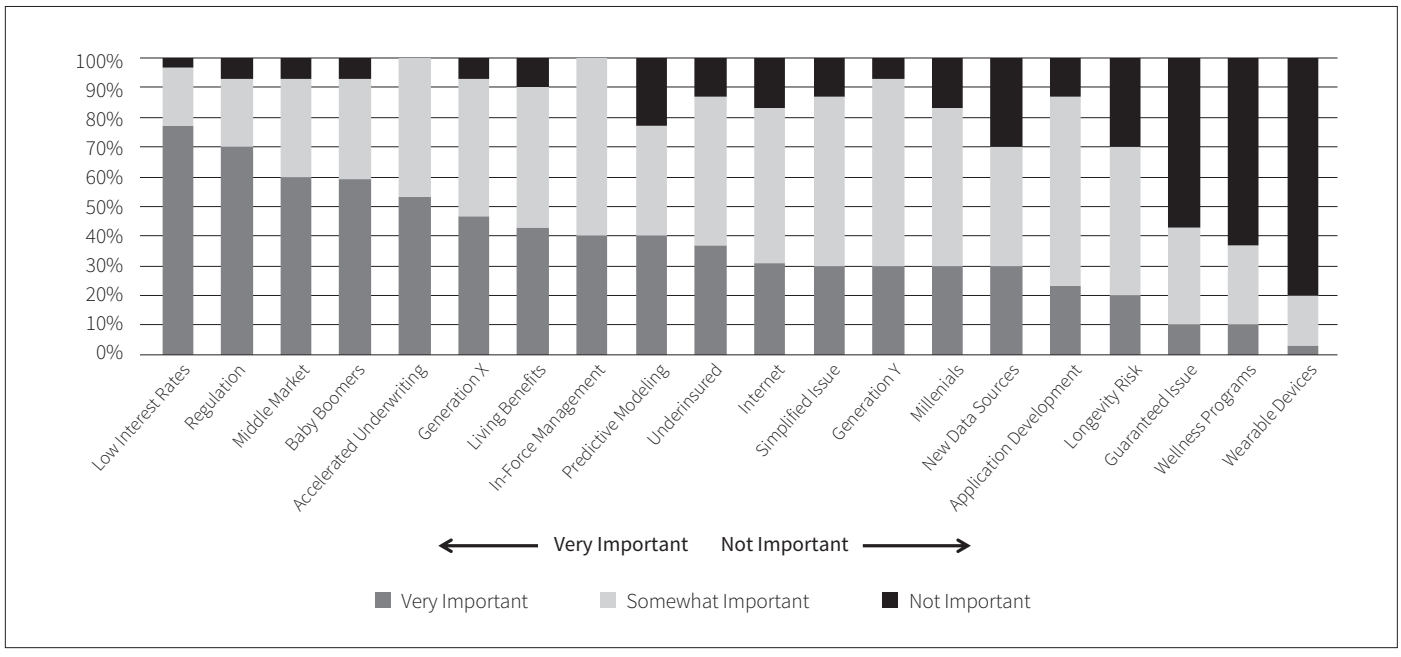


Figure 3
For which steps of the product development process is your company currently using predictive modeling (PM) or beginning to explore the use of predictive modeling?

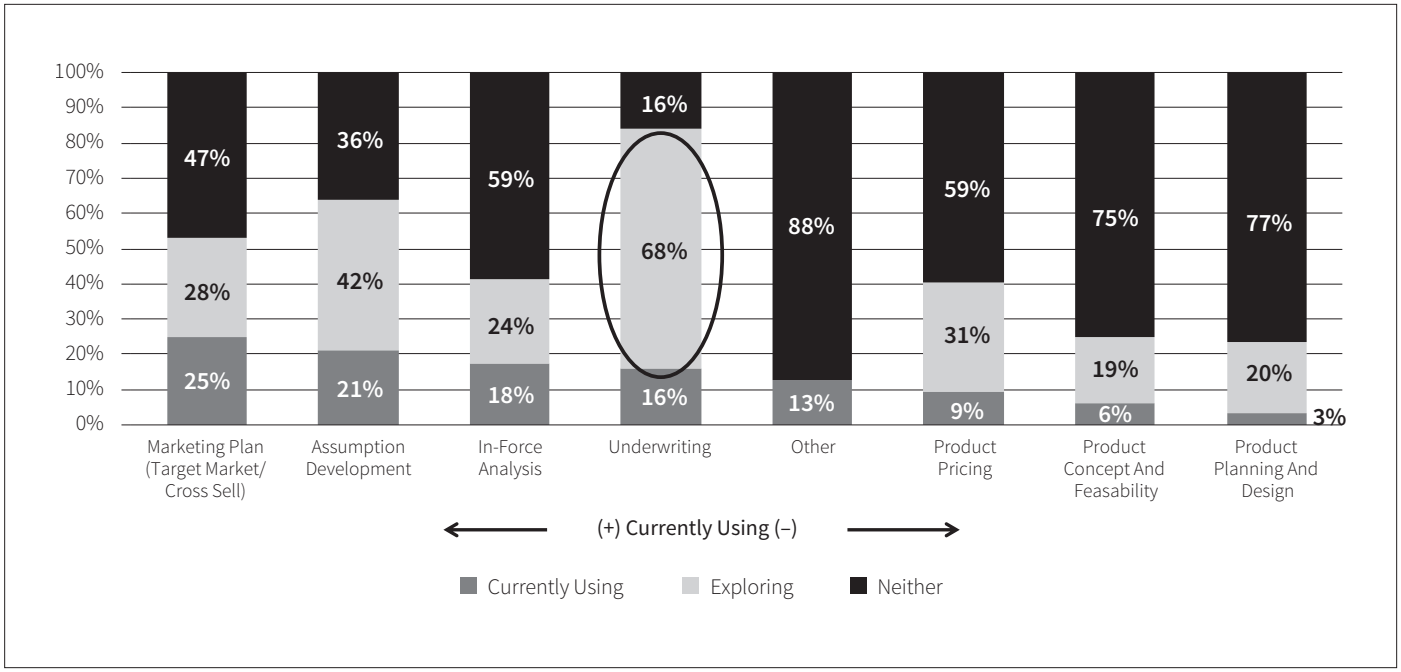


Figure 4
Duration and Timing of Product Development Steps

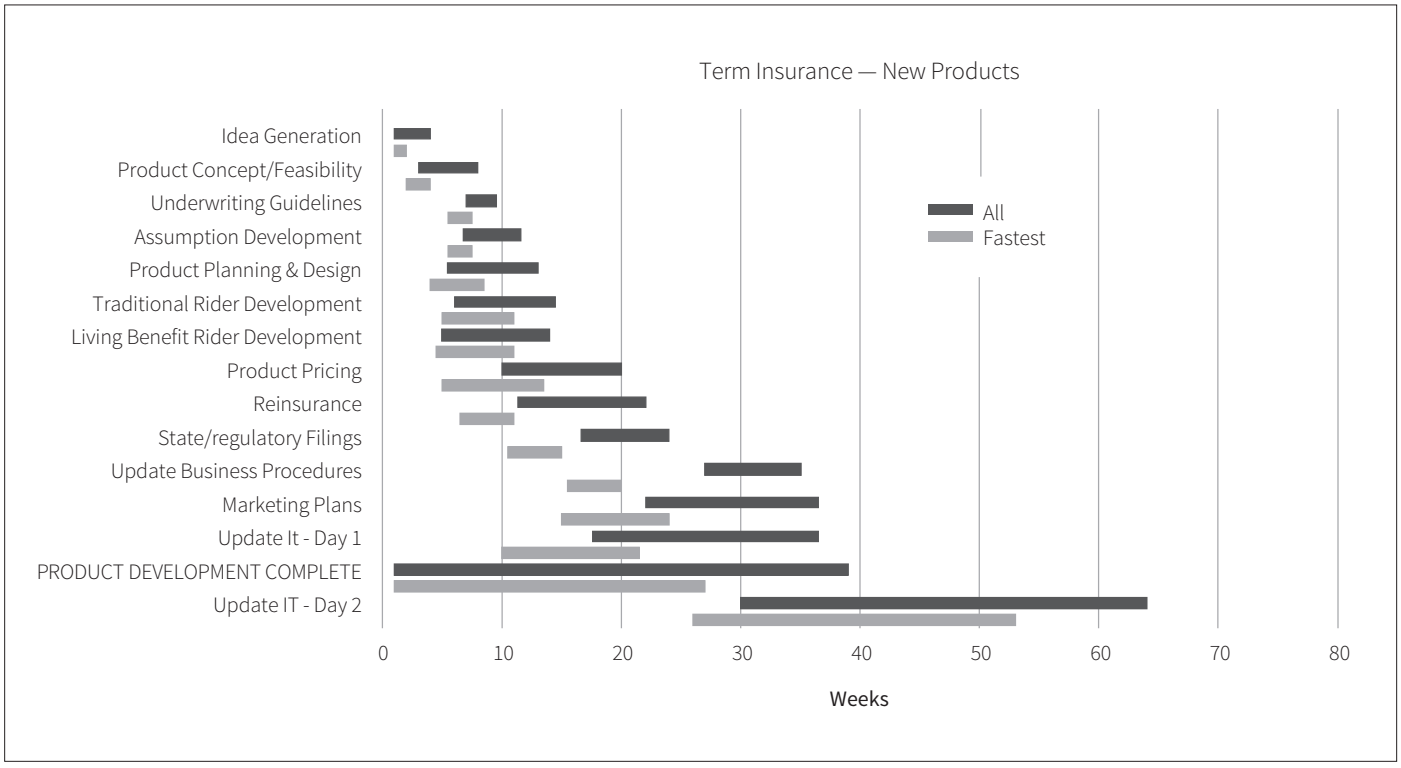
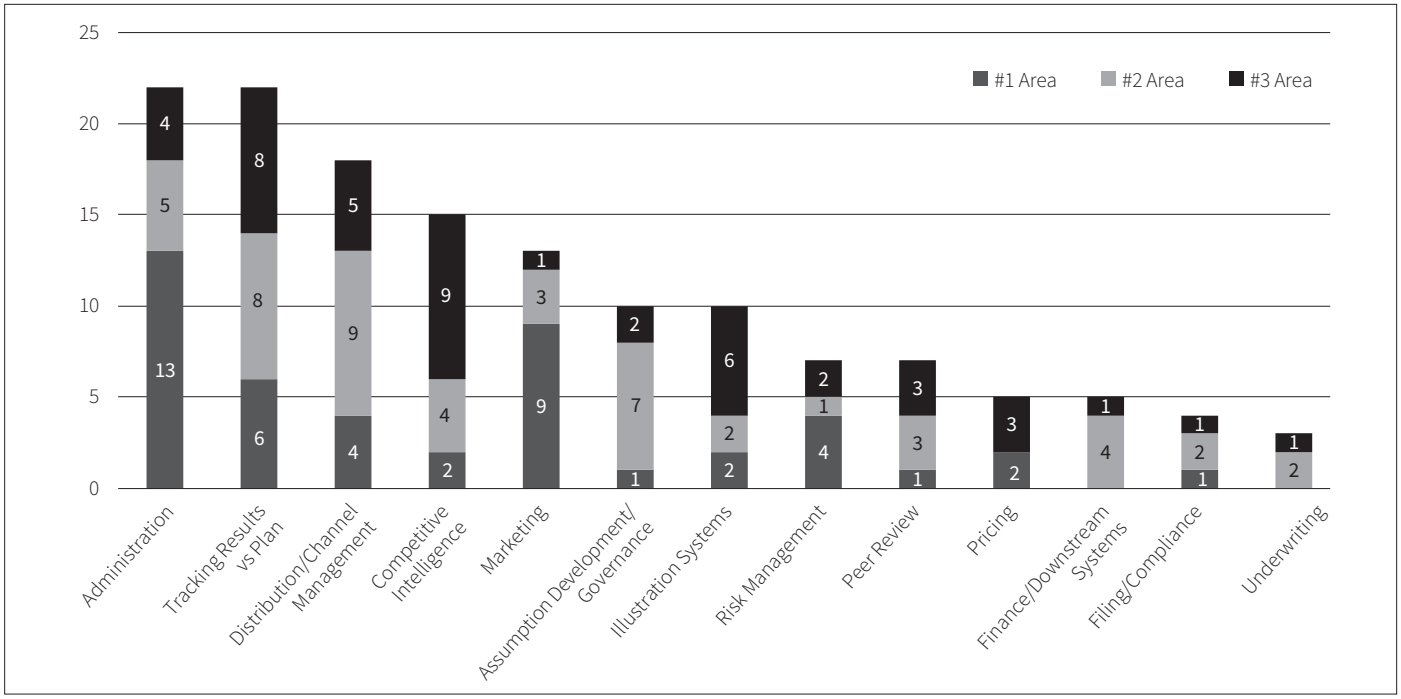


Figure 5
Please select and rank the top three areas in the product development process that are in need of the most improvement in your company.



needs and propensity to buy, disruptive underwriting can lead to compelling products with the right value proposition.

5. HOT TRENDS AREN'T ALWAYS HIGH PRIORITIES.

One trend is the wearables idea in the underwriting process (can and how data could be used). I think another one would just be in general what we here refer to as an "e-initiative," so an electronic application, electronic signatures and the electronic underwriting. See Figure 5.

In recent years, the industry has put a great deal of attention and research on emerging trends, such as wellness programs and the use of wearable devices to collect consumer data. Yet when it comes to actual product development, bottom-line concerns such as low interest rates and meeting regulatory requirements remain the most important considerations. Interestingly, accelerated underwriting and in-force management are the only considerations out of 20 choices to be considered at least "somewhat important" by all survey respondents.

SUMMARY

There are many items to take away from the research. Companies that seek to understand travel time from idea to launch will most keenly focus on Section D of the report. Considering that the survey asked about 2014 actions, product development in 2017 has already been impacted by regulatory changes of a new valuation manual that will likely increase travel times for product development until the process becomes more ingrained in companies.

Administration is identified as an issue, and just because the answer is simple, it does not make it easy. The cost and time to effectively overhaul various processes/systems are too much for most companies and as legacy systems increase, the burden will continue to grow. Use of certain changes in process (e.g., Agile) may alleviate some time constraints.

The research does not have all the answers, but mainly gives companies a chance to look at certain parts of the product development process to benchmark and think through how to potentially improve. ■

Donna Megregian, FSA, MAAA, is vice president & actuary at RGA. She can be reached at *dmegregian@rgare.com*.

ENDNOTE

1 *https://www.soa.org/research-reports/2017/product-development-process/*

Universal Life and Indexed UL Current Trends and Reactions

By Susan J. Saip

Results of Milliman's 10th annual survey of leading universal life (UL) and indexed UL (IUL) products have been compiled, revealing reactions to the various dynamics of this market. Thirty-two carriers submitted responses to the survey related to product and actuarial issues such as sales, profit measures, target surplus, reserves, risk management, underwriting, product design, compensation, pricing and illustrations.

The scope of the Milliman survey included UL with secondary guarantees (ULSG), cash accumulation UL (AccumUL), current assumption UL (CAUL), and the indexed UL (IUL) counterparts of these products. The definition of these product types is shown as follows:

- UL/IUL with Secondary Guarantees: A UL/IUL product designed specifically for the death benefit guarantee market that features long-term no-lapse guarantees (guaranteed to last until at least age 90) either through a rider or as a part of the base policy.
- Cash Accumulation UL/IUL: A UL/IUL product designed specifically for the accumulation-oriented market where efficient accumulation of cash values to be available for distribution is the primary concern of the buyer. Within this category are products that allow for high-early cash value accumulation, typically through the election of an accelerated cash value rider.
- Current Assumption UL/IUL: A UL/IUL product designed to offer the lowest cost death benefit coverage without death benefit guarantees. Within this category are products sometimes referred to as "dollar-solve" or "term alternative."

Highlights of the key findings of the survey are summarized in this article.

UL SALES

The graph in Figure 1 illustrates the UL product mix (excluding IUL sales) as reported by survey participants from calendar years 2013 through 2015, and for 2016 as of Sept. 30, 2016 (YTD 9/30/16). For purposes of the survey, sales were defined as the sum of recurring premiums plus 10 percent of single premiums. Relative to prior survey results, fewer participants reported significant shifts in their UL product mix when comparing the mix at the end of the survey period to that of the beginning of the survey period.

INDEXED UL SALES

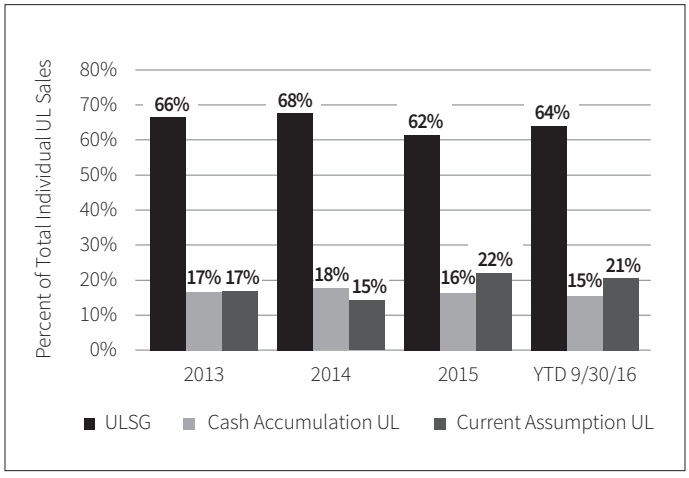
For survey participants, IUL sales during YTD 9/30/16 accounted for 49 percent of total UL/IUL sales combined during YTD 9/30/16, increasing from 34 percent in 2013. Also, the IUL sales percent increased for AccumIUL sales from 2013 to YTD 9/30/16 from 71 percent to 79 percent of total cash accumulation UL/IUL sales. IULSG also increased from 5 percent to 8 percent of total combined ULSG/IULSG sales over the survey period. CAIUL sales, as a percent of total combined CAUL/CAIUL sales, decreased from 32 percent to 30 percent over this period. Similar to responses in the past, overall survey statistics suggest that in the future participants plan to focus more on IUL products, especially AccumIUL, and on CAUL products.

The graph in Figure 2 illustrates the IUL product mix and the significance of AccumIUL products within the IUL market.

LIVING BENEFIT RIDER SALES

Seven of the 12 participants that reported UL/IUL sales with chronic illness riders provide a discounted death benefit as an accelerated benefit. Under the discounted death benefit approach, the insurer pays the owner a discounted percentage of the face amount reduction, with the face amount reduction occurring at the same time as the accelerated benefit payment. This approach avoids the need for charges up front or other

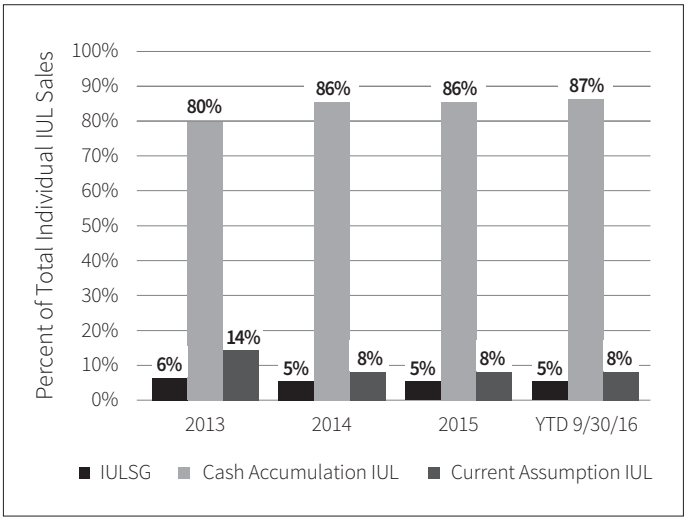
Figure 1
Ul Product Mix by Year



premium requirements for the rider, because the insurer covers its costs of early payment of the death benefit via a discount factor.

Another two participants reported their chronic illness rider uses a lien against the death benefit to provide the accelerated benefit, and one participant uses a dollar-for-dollar death benefit reduction approach. The final two participants use both the lien approach and dollar-for-dollar death benefit reduction approach. Under the lien approach, the payment of accelerated death benefits is considered a lien or offset against the death benefit. Access to the cash value (CV) is restricted to any excess of the CV over the sum of the lien and any other outstanding policy loans. Future premiums/charges for the coverage are unaffected, and the gross policy values continue to grow as if the lien didn't exist. In most cases there are lien interest charges that are assessed under this design. Under the dollar-for-dollar approach, there is a dollar-for-dollar reduction in the specified amount or face amount and a pro rata reduction in the CV based on the percentage of the specified amount or face amount that was accelerated. This approach always requires an explicit charge.

Figure 2
IUL Product Mix by Year



During YTD 9/30/16, sales of policies with chronic illness riders as a percent of total sales were 15.8 percent for UL products and 35.5 percent for IUL products. Because more new IUL products have been developed recently, and many included a chronic illness rider, we see a greater share of chronic illness riders on an IUL chassis. The table in Figure 3 shows YTD 9/30/16 sales with chronic illness riders as a percent of total sales for UL and IUL products separately by product type.

The use of long-term care (LTC) riders attached to life insurance policies, particularly UL/IUL policies, has become an alternative solution to stand-alone LTC policies. This is an important trend to address LTC needs due to the high cost of long-term care, the aging population and the exiting of some life insurers from the stand-alone LTC market. During YTD

Figure 3
Chronic Illness Rider Sales As A Percent Of Total Sales

Calendar Year	Total Individual UL	ULSG	Cash Accumulation UL	Current Assumption UL
UL Sales With Chronic Illness Riders As A Percent Of Total UL Sales				
2013	15.8%	19.1%	9.3%	9.1%
2014	15.5%	18.3%	11.6%	7.2%
2015	14.6%	18.4%	14.9%	3.9%
YTD 9/30/16	15.8%	18.5%	18.8%	5.0%
Calendar Year	**Total Individual IUL**	**IULSG**	**Cash Accumulation IUL**	**Current Assumption IUL**
IUL Sales With Chronic Illness Riders As A Percent Of Total IUL Sales				
2013	30.3%	10.2%	34.4%	15.9%
2014	31.7%	26.0%	32.7%	25.1%
2015	33.1%	29.6%	34.3%	22.1%
YTD 9/30/16	35.5%	39.1%	36.7%	19.5%

Figure 4
LTC Rider Sales as a Percent of Total Sales by Premium

Calendar Year	Total Individual UL	ULSG	Cash Accumulation UL	Current Assumption UL
UL Sales With LTC Riders As A Percent Of Total UL Sales				
2013	16.4%	24.0%	1.6%	0.8%
2014	19.9%	28.9%	1.4%	0.3%
2015	22.3%	31.9%	2.1%	10.3%
YTD 9/30/16	24.0%	33.5%	1.0%	11.8%
Calendar Year	**Total Individual IUL**	**IULSG**	**Cash Accumulation IUL**	**Current Assumption IUL**
IUL Sales With LTC Riders As A Percent Of Total IUL Sales				
2013	9.5%	23.1%	8.6%	8.3%
2014	9.9%	20.5%	9.2%	10.0%
2015	10.6%	13.5%	10.5%	9.7%
YTD 9/30/16	9.8%	8.5%	9.6%	12.6%

9/30/16, sales of policies with LTC riders as a percent of total sales by premium were 24.0 percent for UL products and 9.8 percent for IUL products. Figure 4 shows sales of LTC riders as a percent of total sales (measured by premiums, and weighting single-premium sales at 10 percent) for UL and IUL products separately by product type.

PROFIT MEASURES

The predominant profit measure reported by survey participants is an after-tax, after-capital statutory return on investment/internal rate of return (ROI/IRR). This is consistent with what has been reported in past surveys. The average ROI/IRR target reported by survey participants was 9.9 percent for ULSG, 11.1 percent for AccumUL, 10.5 percent for CAUL, 10.1 percent for IULSG, 12.3 percent for AccumIUL and 12.8 percent for CAIUL.

The charts in Figures 5 and 6 shows the percentage of survey participants reporting that they fell short of, met or exceeded their profit goals by UL product type for calendar year 2015 and YTD 9/30/16, respectively. Of note is the percentage of participants that fell short of their profit goals for ULSG products: 50 percent in 2015 and 63 percent during YTD 9/30/16. As in the past, the primary reasons reported for not meeting profit goals were low interest earnings and expenses.

PRINCIPLE-BASED RESERVES AND THE 2017 CSO

Results from the survey indicate a staggered approach in implementing recent regulatory changes. Principle-based reserves (PBR) may be implemented as early as Jan. 1, 2017, and 27 survey participants reported they expect to implement PBR for all of their UL/IUL products gradually over the three-year phase-in period allowed. Resource issues, time needed, financial impact/cost/benefits, clarification/finalization of PBR/IRS regulations and PBR implementation of other product first were cited as factors impacting the rationale for implementation plans.

Similarly, the earliest effective date for the use of the 2017 Commissioner's Standard Ordinary (CSO) mortality table was

Figure 5
Actual Results Relative to Profit Goals for 2015

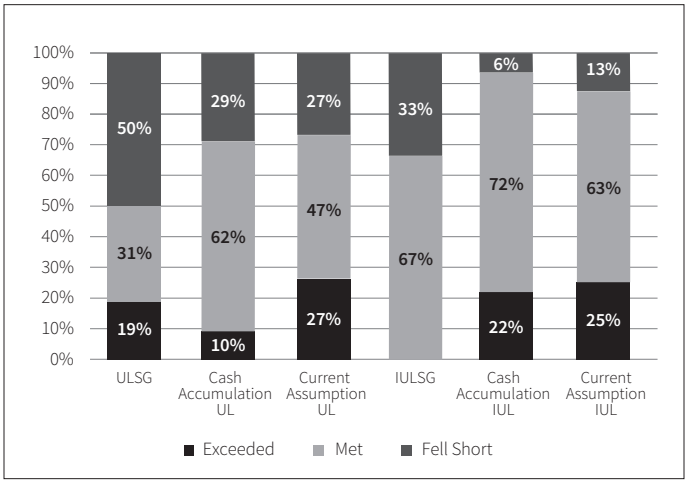
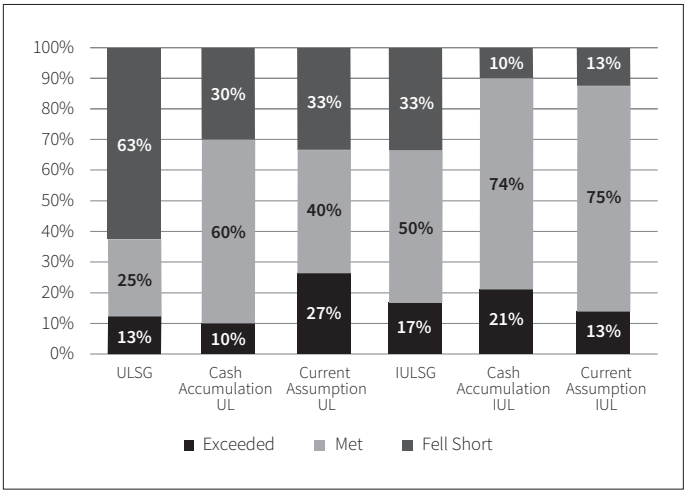


Figure 6
Actual Results Relative to Profit Goals for YTD 9/30/16



Jan. 1, 2017. The 2017 CSO is the new valuation mortality table to be used in the determination of CRVM (Commissioners Reserve Valuation Method), net premium reserves, tax reserves, minimum nonforfeiture requirements and so on. Twenty-two survey participants reported that they would implement this table for all of their UL/IUL products gradually over the three-year phase-in period allowed. Ten participants reported implementation of the 2017 CSO would be product dependent; implementation will be immediate for some products and over the three-year phase-in period for others.

It is not surprising that these regulatory changes are not being implemented immediately, given the complexity of the regulations, the potential impact on pricing and the bottom line, and the strain on resources, especially for smaller carriers.

In addition, 21 participants provided a rating of how effective they believe PBR will be in making reserve financing arrangements (e.g., captives) obsolete. Ratings are shown in the table in Figure 7. More participants believe PBR will be effective rather than ineffective in making reserve financing arrangements obsolete.

Figure 7
Effectiveness Ratings of PBR Making Reserve Financing Arrangements Obsolete

Rating	# Of Responses
Very Ineffective	0
Ineffective	4
Average	9
Effective	6
Very Effective	2

UNDERWRITING

The use of predictive modeling in the life insurance industry has recently gained attention. Predictive modeling utilizes statistical models that relate outcomes/events to various risk factors/predictors. Scoring models in life underwriting are an example of predictive modeling used in the life insurance space. Eleven survey participants use scoring models to underwrite their UL/IUL policies. Eight of the 11 use scoring models for fully underwritten policies, one uses them for simplified issue business, and the final two use them for both fully underwritten and simplified issue business. Eight participants reported using scoring models with automated rules.

The types of scoring models were reported by 10 of the 11 survey participants that use scoring models. In total, seven use lab scoring models, four use credit scoring models and five use scoring models relative to motor vehicle records (MVR).

ILLUSTRATIONS

The credited rate used in IUL illustrations for participants' most popular strategies decreased relative to the illustrated rate of one year prior for 10 of 21 survey participants. One participant reported no change in the illustrated rate, and eight reported increases in the illustrated rate. The median illustrated rate reported was 6.69 percent and the average was 6.58 percent.

The survey has included a number of questions relative to IUL illustrated rates and rates calculated under Actuarial Guideline 49 (AG 49) Section 4A and Section 4C. A new question

In future years, the implementation of PBR, the 2017 CSO table, and new underwriting approaches will likely have a more significant impact on the UL/IUL market than seen in recent years.

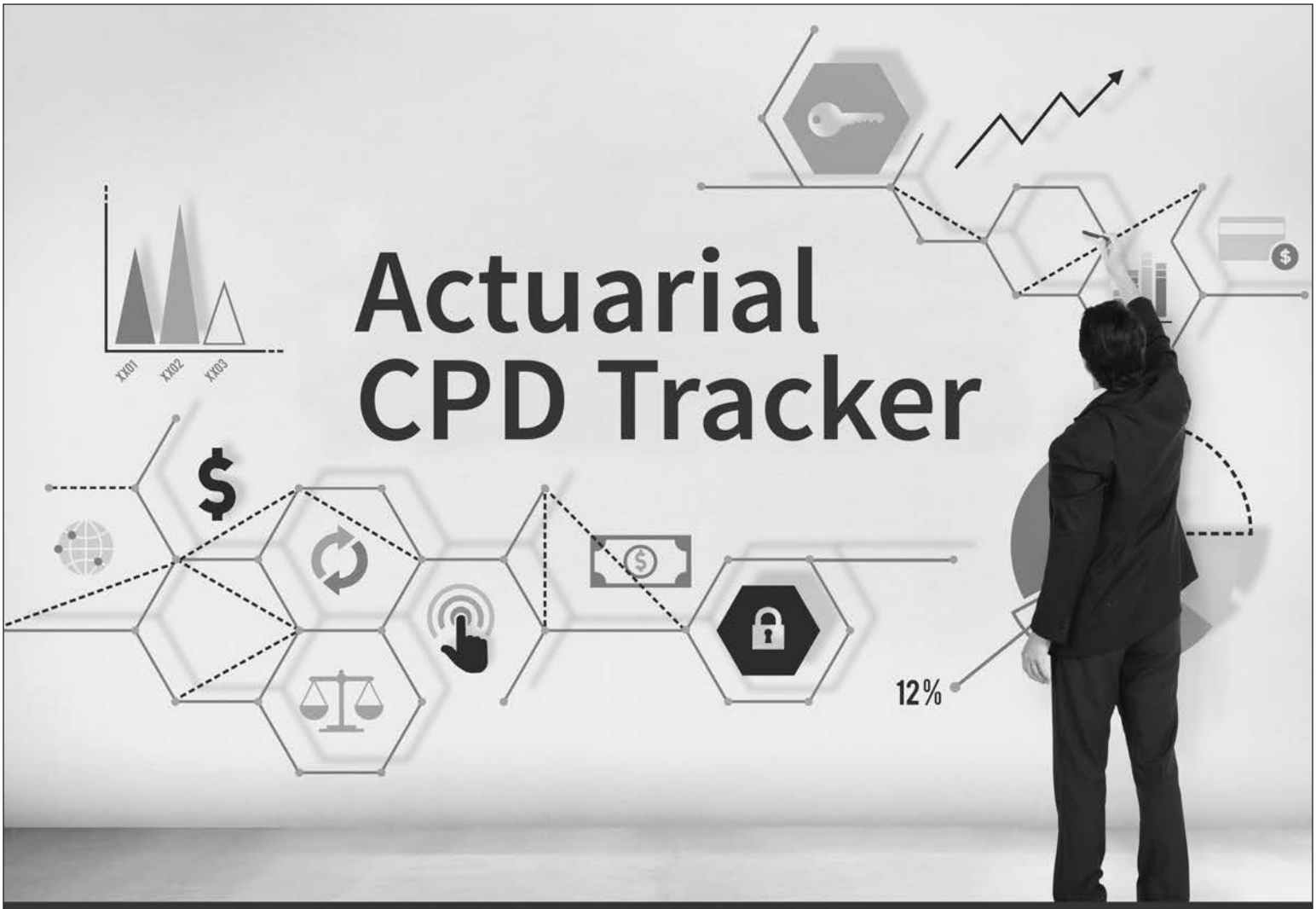
that was included in the survey this year asked participants to report the maximum illustrated rate that was allowed for the most popular strategy/investment choice within their IUL portfolio, both immediately pre-AG 49 and immediately post-AG 49. The pre-AG 49 rates ranged from 5.60 percent to 8.50 percent, with an average of 7.38 percent and a median of 7.65 percent. The post-AG 49 rates ranged from 5.02 percent to 7.75 percent, with an average of 6.69 percent and a median of 6.86 percent.

CONCLUSION

Trends in the UL/IUL market in recent years generally have been due to the popularity of indexed UL and continuing low interest rates, with some reaction to regulatory actions. In future years, the implementation of PBR, the 2017 CSO table, and new underwriting approaches will likely have a more significant impact on the UL/IUL market than seen in recent years. To remain competitive, and even to survive, in this market, it is critical for carriers to address the issues and opportunities that arise.

A complimentary copy of the executive summary of the May 2017 Universal Life and Indexed Universal Life Issues report may be found at: *http://us.milliman.com/insight/2017/Universal-life-and-indexed-universal-life-issues--2016-survey/*. ■

Sue Saip, FSA, MAAA, is a consulting actuary at Milliman. She can be reached at *sue.saip@milliman.com*.



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Pricing Surface

By Feng Sun

Pricing an insurance product requires assumptions, actuarial models and professional judgments; the pricing results are usually accomplished by a set of finite numbers deemed as the best estimate of certain profitability measures, and they are also accompanied by a list of sensitivity testing results to help actuaries better understand any potential deviation from the pricing target due to misestimates, misjudgments or other uncertainties.

This paper suggests expanding the current approach by constructing a pricing surface, or capturing the joint distribution of interested pricing measure driven by pricing variables. In this paper, we will discuss why we use pricing surface, how to construct the surface and what the benefits of using pricing surface are; we also provide an example to illustrate the idea and draw a conclusion based on the discussion.

WHY PRICING SURFACE

The pricing results are driven by pricing variables. What value we assign to a variable is based on the assumption. Some assumptions can be obtained directly from the market such as interest rate or from a company's experience of similar products (such as mortality or lapses). Other assumptions may require professional judgment if the experience is relevant but not directly applicable.

Due to various degrees of uncertainty of the assumptions, a point estimate (usually labeled as best estimate) is not sufficient to provide the complete picture of pricing results even with a list of sensitivities, let alone to support the decision-making process. Here are a few examples.

It is a challenge to reflect economy of scale.

For an insurance company, it is common to see a fight between sales force and pricing actuaries. The sales force wants to lower the price to make the product more competitive or easy to sell; they argue that as long as the marginal profitability (where only policy-driven expenses are included, no overhead expenses) is positive, additional policies sold will make a positive contribution to the company. On the other hand, pricing actuaries feel that pricing should reflect the true cost to the company. Each side has its own argument. This assumption is driven by sales volume. If more policies were sold, the cost per policy would go down, and the economy of scale can be partially achieved. The profitability could converge to pricing results with marginal expense assumptions to a certain degree.

When pricing actuaries develop the expense assumption, they usually have a certain sales target in mind and use it to spread out the overhead expenses. Once determined, it won't change. Although actuaries have tested two extreme cases, it is difficult to reflect profitability with the actual sales level. This fight is usually resolved in front of the CEO and/or CFO with a reasonable balance between profitability and growth for the company.

Cross-terms among the pricing variables are usually ignored.

Sensitivity tests are commonly performed at one dimension (or one variable) and one dimension only. The interactions between two pricing variables (or cross-terms) are usually ignored. For some products, the cross effect can be significant, especially at the tail. For example, for single premium immediate annuity (SPIA) product pricing, the company performs sensitivity tests on interest rate and longevity, respectively, but did not test the combined changes of interest rate and longevity at the same time. Some actuaries found that the impact of the cross-term can be greater than the two individual sensitivity results combined at the tail. The reason is that the change of one pricing variable magnifies the impact of the change on the other variable. In this case, the longevity extends the duration and makes the profitability more sensitive to the interest rate. Although the effect may not be significant with moderate changes of assumptions, it should not be overlooked until tested. Of course, some cross effects can go the opposite way, where the changes of two pricing variables can be off-set to each other to certain extent. This would be good news for the company. When this is observed, pricing actuaries or risk managers need to know as well.

More sensitivity tests may not be enough.

To price an innovative product, it is a challenge to get comfortable with actuarial assumptions because of lack of experience (if we assume experience is relevant). Actuaries usually rely on the experience of similar products, or competitors' experience (usually indirectly from consulting firms), or simply rely on their own professional judgment. No matter where the assumptions landed, they are still actuaries' best guess. The high level of uncertainty leads to more sensitivity tests to help understand the results that could potentially deviate significantly from the mean. However, these sensitivity tests may not be enough to cover all possibilities for certain assumptions, especially at the extremes, where human judgement has its limitations. As an example, when interest rates were above 10 percent the in

1980s, probably no pricing actuaries at that time would have thought the rate can go down to today's level.

Despite the issues of the current approach, pricing exercises are usually complete before the product is launched. After the products sold turn into in force and are passed on to in-force managers, there are no further follow-ups in the pricing area. This can be dangerous as the pricing assumption may change from time to time; and the actual profitability may significantly deviate from pricing target.

Pricing surface can help address these issues by selecting the right pricing variables and building the joint distribution of the pricing results with pricing variables chosen.

HOW TO CONSTRUCT A PRICING SURFACE

Because the joint multivariate distribution is usually unknown, it makes constructing a surface a challenge. However, there are a few simplified approaches.

One approach is the so-called curve fitting, which requires multiple point estimates to help look for a statistical distribution that best fits these points. Once the distribution is identified, actuaries can use the distribution to find other pricing points they are interested in.

Another approach is to apply multiple-variate Taylor expansion using a few observed points. Here we use Taylor expansion to illustrate the process.

Step 1: Define Pricing Variables and Sensitivity Levels

Taking SPIA pricing as an example, we assume the pricing result is a function of two pricing variables, namely interest rate and mortality rate, because we assume they drive the pricing results. We also assume that function meets the certain mathematical assumptions such that we can apply Taylor series to this function.

We then define the sensitivity levels so that we calculate the first and second orders of the derivatives. In Table 1, we choose the following:

Table 1
Sensitivity Levels of Pricing Variables

Pricing Variables	Changes of Pricing Variable	# of Tests
Best Estimate	None	1
Interest rate ("R")	+/−1% parallel shift	2
Mortality ("M")	+/−10% of base mortality table	2
Interest rate × Mortality	+/−1% parallel shift × +/−10% Mortality	4

Step 2: Calculate the First and Second Derivatives

After obtaining nine actual testing results, including the best estimate, we calculate the first order of derivatives, the second order of derivatives and the second order of derivatives for the cross term.

The notations used in the formulas are as follows:

ΔR = the change in interest rate as defined

ΔM = the change in mortality as defined

V_0 = the baseline value with pricing assumptions

V_{R-} = the ending value when interest rate declined by ΔR

V_{R+} = the ending value when interest rate increased by ΔR

V_{M-} = the ending value when mortality declined by ΔM

V_{M+} = the ending value when mortality increased by ΔM

V_{R+M+} = the ending value when interest rate and mortality increased

V_{R+M-} = the ending value when interest rate increased and mortality decreased

V_{R-M+} = the ending value when interest rate declined and mortality increased

V_{R-M-} = the ending value when interest rate and mortality decreased

To calculate first order of derivatives with respect to interest rate, we have the following formula:

For rate up, the formula becomes

$$\left(\frac{\partial V}{\partial R}\right)_{+} = \frac{V_{R+}/V_0 - 1}{\Delta R}$$

Similarly, for when the rate goes down, we have

$$\left(\frac{\partial V}{\partial R}\right)_{-} = \frac{V_{R-}/V_0 - 1}{\Delta R}$$

The first order of derivatives with respect to mortality can be done in the same fashion.

Similarly, for second order of derivatives, we take the calculated first order of derivatives and calculate them using the following formulas:

For interest rate move,

$$\left(\frac{\partial^2 V}{\partial R^2}\right)_+ = \frac{V_{R+}/V_0 - 1 - \left(\frac{\partial V}{\partial R}\right)_+ \Delta R}{(\Delta R^2)} \times 2$$

For mortality move,

$$\left(\frac{\partial^2 V}{\partial M^2}\right)_+ = \frac{V_{M+}/V_0 - 1 - \left(\frac{\partial V}{\partial M}\right)_+ \Delta M}{(\Delta M^2)} \times 2$$

To calculate second orders of derivatives for cross items, we need to specify the directions of the movement of pricing variables.

For interest and mortality rates' upward movement, we have

$$\left(\frac{\partial^2 V}{\partial R \partial M}\right)_{++} =$$

$$\frac{V_{R+M+}/V_0 - 1 - \left(\frac{\partial V}{\partial R}\right)_+ \Delta R - \left(\frac{\partial V}{\partial M}\right)_+ \Delta M - \frac{1}{2}\left(\frac{\partial^2 V}{\partial R^2}\right)_+ (\Delta R)^2 - \frac{1}{2}\left(\frac{\partial^2 V}{\partial M^2}\right)_+ (\Delta M)^2}{(\Delta R \Delta M)}$$

Similarly, we can calculate the following

$\left(\frac{\partial^2 V}{\partial R \partial M}\right)_{+-}$, $\left(\frac{\partial^2 V}{\partial R \partial M}\right)_{-+}$ and $\left(\frac{\partial^2 V}{\partial R \partial M}\right)_{--}$.

Step 3: Estimate the Impact Using Taylor Series

When the derivatives are calculated, we estimate the final movement in the target value that is driven by pricing variables using the following formula. As an example, if we want to estimate the final value with a rate increase of Δr and a mortality increase of Δm, we will have

$$\Delta V_{++} = \left(\frac{\partial V}{\partial R}\right)_+ \times \Delta r + \left(\frac{\partial V}{\partial M}\right)_+ \times \Delta m$$

$$+ \frac{1}{2}\left[\left(\frac{\partial^2 V}{\partial R^2}\right)(\Delta r)^2 + \left(\frac{\partial^2 V}{\partial M^2}\right)(\Delta m)^2 + 2 \times \left(\frac{\partial^2 V}{\partial R \partial M}\right)_{++} \times \Delta r \times \Delta m\right]$$

Other combinations of moves will be estimated in similar fashion.

We then apply the Taylor expansion formula to construct a pricing surface so that we can estimate the pricing results for any combination of mortality and interest rate changes.

To illustrate, the pricing surface in Figure 1 was plotted to show the joint distribution of profitability (as percentage of baseline or best estimate) by interest rate and mortality changes (relative to best estimate assumptions).

Here we not only see the relationship between profitability and each individual pricing variables while holding the other variable constant, but also see the cross effect of the two variables. The change of the steepness of the slope tells us that the cross effect is not even across the spectrums, because it would be, otherwise, a flat surface tilted at an angle.

Of course, the estimates can be improved if using third order of derivatives. Also, the users can easily expand the exercise to include more than two pricing variables. For example, selecting number of policies sold as the pricing variable can address the expense assumption issues we discussed earlier; it could also influence the results driven by volatility of mortality or lapses if those variables are modeled stochastically.

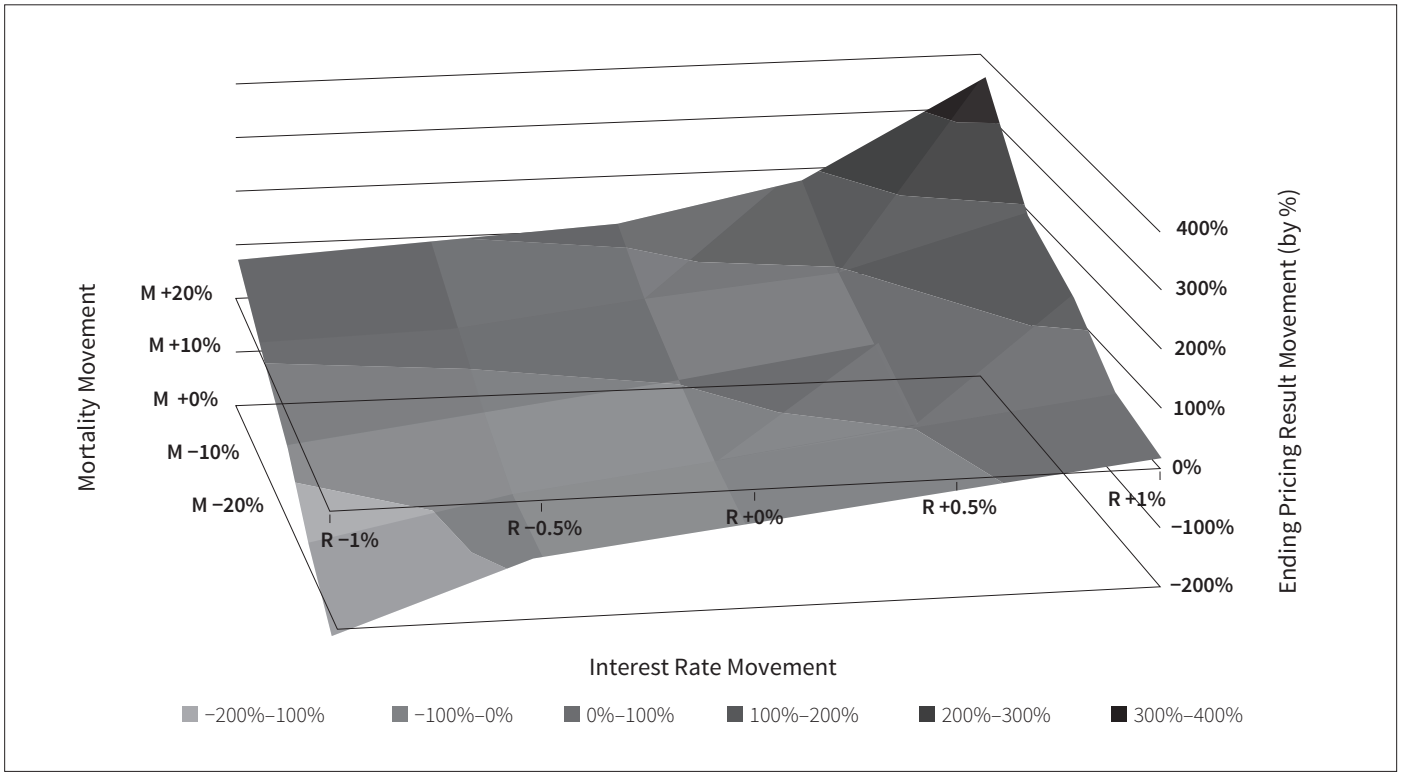
THE BENEFITS OF PRICING SURFACE

From the example, one can see that by constructing the pricing surface, we are able to resolve issues mentioned before. Here are the benefits:

- The pricing surface provides a joint distribution of the pricing results; actuaries not only get the mean and variance, but also its relationship with all pricing variables (interaction among these variables or cross effects). Diversification or magnification between two or more pricing variables is observable. So here we suggest, even with no plan for actuaries to construct pricing surface, to perform sensitivity testing on cross term for better pricing.

- The pricing surface helps monitor the profitability of sales that may derivate from initial pricing target. Ideally, once priced, the profitability of a product does not change. In reality, this may not always be the case; the market environment changes over time. Assumptions change as the experience emerges. A company's pricing team or in-force management team cannot afford to keep up with the changes and conduct repricing exercise as frequently as they want to, or to monitor the actual profitability of the new sales bring to the table due to real-time changes at point of sale from original pricing. With pricing surface, one can either confirm the pricing results for recent sales, or quantify the gap between the actual and pricing results, and pinpoint the drivers. This helps the company make the right decision with respect to encouraging sales when the environment is favorable or put a limit of sale when otherwise. For example, using the preceding chart and taking SPIA, when experiencing persistent low interest rate (e.g., 0.5 percent lower than pricing) and seeing mortality improves overtime (e.g., mortality is reduced by 5 percent), the pricing surface would tell us that the profitability would be reduced by 55 percent. If the company feels they are missing pricing target by a margin, they may choose to slow down or stop the sales or conduct repricing if the market demand persists. On the other hand, if the interest rate and mortality movement are exactly opposite, the pricing surface shows the profitability would increase by 71 percent. This better-than-expected profitability could make the company

Figure 1
Pricing Surface with Interest Rate and Mortality Movement



create additional incentive to encourage sales or consider reducing the premiums (one could build the surface with premium as a variable) to boost sales. Nevertheless, when it comes to repricing, if there is no change in product design, the surface should contain all the results already, no repricing exercise is necessary.

- Finally, the pricing surface can facilitate communications both within and outside a company. If a number of policies sold is selected as a pricing variable and pricing surface is constructed accordingly, it will capture the relationship between the pricing results and number of policies sold. As a result, there is no need to argue between using marginal expense pricing or using fully allocate expense assumptions, because it is baked in pricing and the surface will show how the pricing results vary as number of policies sold change. If only one policy is sold, the surface will tell us the product is expensive or the profitability is low because all the overhead expense has to be allocated to one policy. At the other extreme, if huge amount of policies are sold (up to certain extent or high end of economy of scale under current service capacity), the surface will say that the profitability is close to the one when marginal expense assumption is used under traditional pricing. The actuals profitability is probably somewhere in between. This surface would facilitate the communication with fields or senior management by bringing everything to the table. If a certain sales goal is met by the sales force, marginal expense assumption can be achieved, the product can be cheaper, on the other hand, if sales are lagging, the product has to be expensive to meet the profitability target. This tool could also help the company to communicate with regulators or rating agencies if used properly.

CONCLUSION

While current best estimate pricing results provides information for decision making, a pricing surface offers a comprehensive view of the pricing results throughout the spectrum of each driver that might alter the pricing results. Although constructing the joint distribution is a challenge, there are simplified approaches to make it happen. Furthermore, it is worth the effort to obtain the pricing surface. It helps make an informed decision and facilitate the pricing conversation within and outside a company. ■

Feng Sun, FSA, CERA, MAAA, is AVP & actuary at MassMutual Financial Group. He can be reached at *fsun@massmutual.com*.

Universal Life with Secondary Guarantees Survey Summary

Through its Policyholder Behavior in the Tail workgroup, the Society of Actuaries has published a new report[1] summarizing the results of its most recent assumption survey for Universal Life Insurance with Secondary Guarantees. Highlights are as follows:

- 25 companies participated in the survey up from 20 last time, covering $740 billion of insurance inforce.
- Capital requirements are highly dependent on assumptions for lapse rates and investment returns.
- A wide range of assumptions is evident across companies, particularly for "tail" scenarios and elderly insureds, only some of which is explained by product design differences.

This is the latest in a series of surveys[2] covering Universal Life Insurance with Secondary Guarantees and Variable Annuities, respectively, started in 2007. The motivation for these surveys is the high degree of sensitivity that these products have to elective policyholder behavior, and the emergence and changes in these behaviors in recent years. The reports from these surveys should be of interest to actuaries in product development, pricing, inforce management, and valuation roles, and should aid in the development of prudent policyholder behavior assumptions for these important product lines.

Anyone interested in more information or learning about how to participate in future surveys should contact Barbara Scott at *bscott@soa.org*. ■

ENDNOTES

1 *https://www.soa.org/research-reports/2017/2017-ul-second-guarantee-survey/*

2 *https://www.soa.org/research/topics/risk-mgmt-res-report-list/*

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